UK INDICATORS OF SUSTAINABLE FORESTRY

2nd Consultation

Economics and Statistics Unit
Forestry Commission
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Contents

UK INDICATORS OF SUSTAINABLE FORESTRY

Introduction

1. This document contains a draft set of UK Indicators of Sustainable Forestry, for public comment. These national-level indicators provide information about the current state, and trends over time, of woodlands and their management. They monitor forestry's contribution to sustainable development, expanding upon the forestry indicators in "Quality of Life Counts" (DETR, December 1999). They also form part of the programme of monitoring of sustainable forest management, as outlined in the UK Forestry Standard (FC, January 1998), but there is now an opportunity for the indicators to evolve from those set out in the Standard.

2. Where possible, this set of indicators also gives data for England, Scotland, Wales and Northern Ireland, to give a comparable overview. In each country, these indicators can be supplemented by indicators linked to specific objectives and actions in the country Forestry Strategies.

3. This document is available from the "indicators of sustainable forestry" page on the Forestry Commission website. The page address is http::/www.forestry.gov.uk/sfindicators, or it can be accessed from the home page of the Economics & Statistics area of the FC internet website www.forestry.gov.uk/statistics by clicking on the link for sustainable forestry indicators.

4. Comments on the draft UK Indicators of Sustainable Forestry can be sent by post to Economics & Statistics Unit, Forestry Commission, 231 Corstorphine Road, Edinburgh, EH12 7AT, by fax to 0131 316 4344, or by email to statistics@forestry.gsi.gov.uk. The consultation period runs from 7 February to 2 May 2002. Any questions about the consultation can be directed to Simon Gillam (0131 314 6280) or Vicky West (0131 314 6218).

UK Indicators Process

5. In 1999 the Forestry Commissioners agreed that a set of UK Forestry Indicators should be developed, based on the UK Forestry Standard and the Pan-European Process, and also relevant to the country Forestry Strategies. The proposed indicators should then be subject to wide consultation. A consultation draft was developed during 2000, and issued for external expert consultation in March 2001. This is still accessible from the "indicators of sustainable forestry" website page. During the consultation period, workshops were run at Bromsgrove and Antrim, to discuss the possible indicators and priorities; reports from both workshops are available from the same website page. Written comments were received until June 2001.

6. A set of indicators has now been developed, taking account of the expert comments and views on priorities, and liaising with those who may be able to provide relevant data. The work was delayed, principally by the departure of two of the statisticians who were leading this work, but has now advanced to a stage where we would welcome further external comments. If no major problems emerge in this consultation, it should be possible to have the indicators ready for publication by June 2002.

7. The indicators have been grouped into five categories.

- Woodland
- Biodiversity
- Condition of forest and environment
- Timber and other forest products
- People and forests

8. Each category contains 7-10 indicators, giving a total of 38 indicators, although one indicator can incorporate information from more than one data source. The UK Indicators of Sustainable Forestry are presented in a similar format to the UK Indicators of Sustainable Development. Each indicator typically has a chart and a small table, and several paragraphs of text indicating the key points, relevance, trend and background. The choice of indicators was influenced by the availability of data, but some important topics for which we do not currently have data (e.g. loss of woodland) are included in the proposed indicators.

9. The initial structure of this set of UK indicators was based on the Pan-European Criteria and Indicators, and there will be a requirement for international reporting based on that structure. However, for each potential UK indicator, we have to assess whether it is relevant and useful for the UK, the current quality of information and the time scale over which this can be improved (a few months or perhaps several years).

10. Where possible, we want to use existing sources of data. Data on many aspects already contribute to statistics published by the Forestry Commission (and in some cases Northern Ireland Forest Service). For other aspects statistical information was compiled for the international Forest Resources Assessment 2000. Consultations and other discussions with experts during 2001 have identified or clarified the prospect of using other data sources, although some may require enhancement to produce adequate data for Indicators of Sustainable Forestry. New data collections, particularly for environmental data, may require substantial additional resources. Any proposals will have to be assessed on their merits, taking account of their value as part of the set of indicators, their costs and availability of funding, and their opportunity costs (what may have to be given up to get them).

11. Where possible, all indicators published in the UK Indicators of Sustainable Forestry should be broken down to show information for England, Scotland, Wales and Northern Ireland. The publication will not give data for smaller geographic areas, such as regions or local authority areas.

Other Processes

12. The UK Indicators of Sustainable Forestry need to take account of other processes that develop indicators:

- Pan-European Criteria and Indicators (C&I) for Sustainable Forest Management (SFM) were agreed during the 1990s. Many countries have now published their own national reports on C&I for SFM. The Pan-European C&I are now being reviewed by international working groups (with FC participation), in a process that is due to be completed by June 2002.

- Efforts were made to collect comparable data for most aspects of the Pan-European C&I, through the Temperate & Boreal Forest Resources Assessment (TBFRA 2000). This was published in May 2000, followed by a Global FRA in early 2001.

- UK Sustainable Development Indicators were published in December 1999 as "Quality of Life Counts". They include two indicators for forestry in the UK – total area of woodland and area of ancient semi-natural woodland – and a third indicator to be developed for forest management.

- Sustainable Development Indicators are being developed by the devolved administrations in Scotland and Wales.

- The Forestry Commission National Office for Scotland has developed a draft set of indicators for the Scottish Forestry Strategy. At present there is no similar draft set for England, Wales or Northern Ireland.

- There are links between the development of indicators, monitoring at forest management unit (FMU) level for the UK Forestry Standard, and certification standards such as the UK Woodland Assurance Standard (UKWAS).

- There is also related work by Non-Government Organisations, particularly the WWF Forest Scorecard, for which the second edition was published in January 2000. This addressed a gap in officially published information, and dealt with the issues perceived to be important by that NGO.

Simon Gillam
Economics & Statistics Unit
Forestry Commission
7 February 2002

UK Indicators of Sustainable Forestry

A. Woodland 1. Area of woodland 2. Tree Species 3. New woodland creation 4. Loss of woodland 5. Area of managed forest 6. Area of each management type 7. Woodlands in landscape	**B. Biodiversity** 1. Ancient woodland 2. Native woodland 3. Native woodland condition 4. Richness of fauna 5. Richness of flora 6. Natural regeneration of woodland 7. Diversity of woodland within a stand
C. Condition of forest and environment 1. Air pollutants 2. Crown density 3. Damage by fire and wind 4. Other damage 5. River habitat quality 6. Soil chemistry 7. Water quality 8. Surface water acidification 9. Water yield and stream flows 10. Pollution incidents	**D. Timber and other forest products** 1. Volume of growing stock 2. Harvesting compared with annual increment 3. Timber production and future availability 4. Home-grown as % of consumption 5. Carbon storage 6. Economics of forestry 7. Value added in wood processing
E. People & Forests 1. Visits to woodland 2. Extent of open public access 3. Employment in forestry and related activities 4. Accidents in forest workforce 5. Value of social & environmental benefits 6. Historic environment 7. Public awareness and community involvement	

UK Indicators of Sustainable Forestry

A. Woodland

A1. Woodland area

A2. Tree species

A3. New woodland creation

A4. Loss of woodland

A5. Area of managed forest

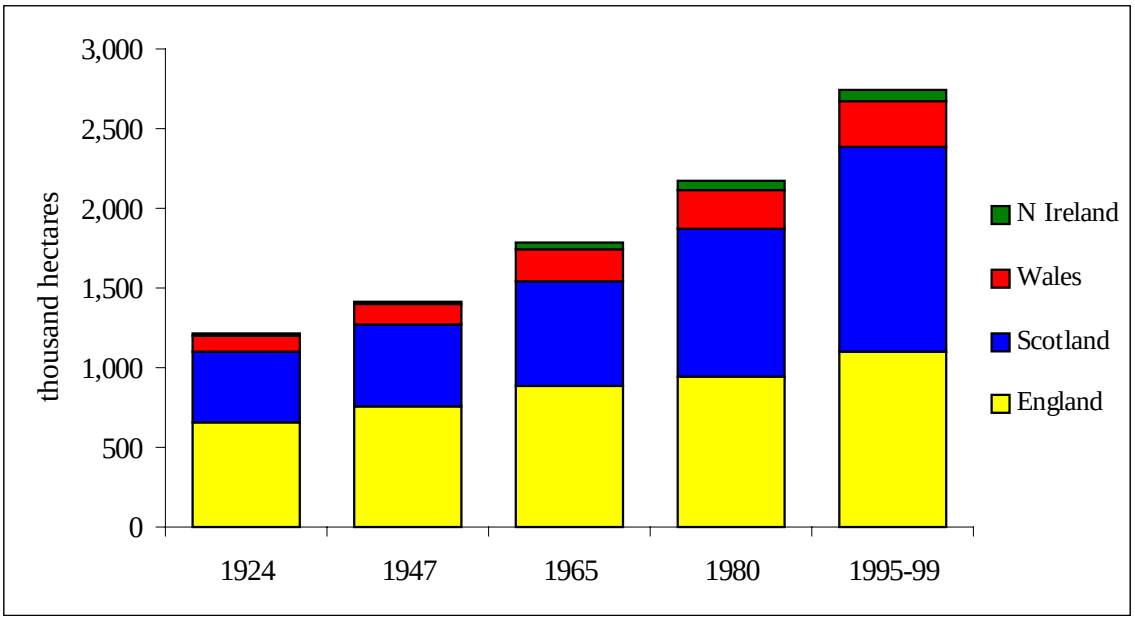
A6. Area of each management type

A7. Woodlands in landscape

A1. Woodland area

UK Woodland area

	thousand hectares						%
	1924	**1947**	**1965**	**1980**	**1995-99**	**2001**	***2001***
England	660	755	886	948	1,097	1,100	*8.4*
Scotland	435	513	656	920	1,282	1,317	*16.9*
Wales	103	128	201	241	287	289	*13.9*
N Ireland	13	23	42	66	81	83	*6.1*
UK	**1,211**	**1,419**	**1,785**	**2,175**	**2,751**	**2,790**	***11.5***



Sources: GB Censuses of Woodland 1924 to 1980, National Inventory of Woodlands & Trees (NIWT) 1995-99, and Northern Ireland Statistics. Unlike previous Censuses, NIWT 1995-99 was carried out as a rolling programme.

Note: Areas for 2001 were projected forward from varying base dates in 1995-99, taking account of new woodland creation and other changes. They are not included in the chart, because the gap since 1995-99 is much shorter than the intervals between censuses.

A1. Woodland area *cont.*

Key Points The area of woodland in the UK has increased through the 20th century, from around 5% cover at the start of the century to over 11% now. In 2001, woodlands covered 8% of England, 17% of Scotland, 14% of Wales and 6% of Northern Ireland

Relevance Forests and woodlands contribute to many sustainable development goals. They enhance our landscape and are habitats for wildlife. They are places for leisure and recreation and are an economic resource for timber production, tourism, and local development and regeneration. The aim is to expand the area of woodland to achieve these multiple benefits.

Trend Much of the increase in woodland areas this century came from new commercial conifer plantations in the 1950s to 1980s, especially in upland areas of Scotland, planted by the Forestry Commission and private owners. During the 1990s, 15-20 thousand hectares of new woodland have been created each year in the UK, mostly by private owners assisted by the Woodland Grant Scheme and other government grants, and the majority of new woodland creation is now broadleaved woodland or native Scots pine.

Background Over previous centuries, there was a gradual loss of forest cover in the UK, which fell to its lowest level of 5 per cent at the start of this century. Today, the area of woodland has doubled from that low. The areas for 2001 are based on latest GIS data for Forest Enterprise and private woodland areas projected forward from the National Inventory of Woodland.

Notes This is indicator S10 in Quality of Life Counts.

A2. Tree species

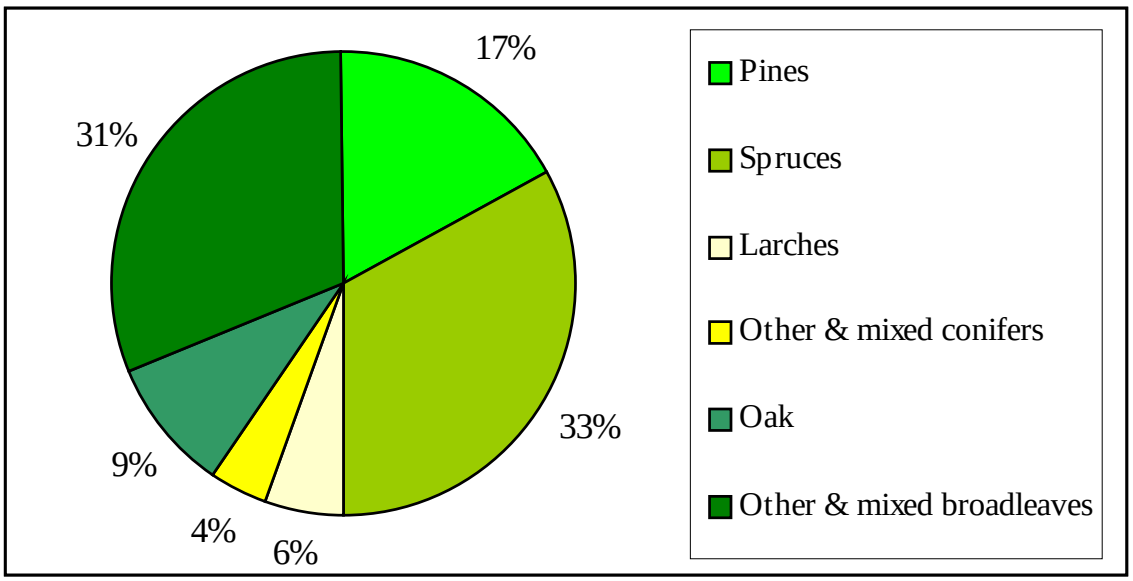
Tree species – Great Britain

thousand hectares

	1947	1965	1980	1995-1999			
	Great Britain High Forest only			GB	Eng	Scot	Wales
Total	**724**	**1,267**	**1,881**	**2,377**	**988**	**1,123**	**266**
Total Conifers	**382**	**917**	**1,321**	**1,046**	**340**	**916**	**149**
Scots pine	147	252	241	227	82	140	5
Lodgepole pine	1	53	127	135	7	122	6
Corsican pine	16	37	47	47	41	2	3
Sitka spruce	68	248	526	692	80	528	84
Norway spruce	54	106	117	79	32	35	11
Larches	79	147	152	134	47	65	23
Douglas fir	15	43	47	45	24	10	11
Mixed & other conifer	3	31	64	48	28	13	6
Total Broadleaves	**342**	**350**	**560**	**971**	**648**	**206**	**118**
Oak	175	166	172	223	159	21	43
Beech	65	66	74	83	64	10	9
Sycamore	23	28	49	67	49	11	7
Ash	34	32	70	129	105	5	19
Birch	27	15	68	160	70	78	13
Mixed & other broadleaves	17	43	127	309	202	81	28

Note: Areas for 1995-99 from National Inventory - exclude felled, coppice and integral open space. Previous Census figures also exclude scrub – i.e. High Forest only.

Main tree species in GB 1995-1999 National Inventory



A2. Tree species *cont.*

Key Points Conifers make up about 60% of woodland in Britain, about half of the conifer area being Sitka spruce. The proportion of broadleaves has been increasing in recent years.

Relevance This gives an indication of the overall makeup and diversity of Britain's woodlands; there is a public preference for more mixed and broadleaved woodland. An increase in the area of broadleaves (and of native Scots pine) should bring environmental benefits – see biodiversity indicators. Sitka spruce is the species best suited to producing softwood timber in many parts of Britain – see timber indicators.

Trend The area of Sitka spruce doubled between 1965 and 1980, and increased by another third by 1995-99. In recent years the figures also show substantial increases in the area of broadleaves, but some of the apparent increase in 1995-99 is due to the inclusion of a species breakdown for scrub for the first time, and the better coverage of the 1995-99 National Inventory.

Background The changing species mix has been influenced by changing priorities of forestry policy, with more importance now given to environmental and social objectives. In areas of commercial forestry where timber production is the main objective, Sitka spruce has become more dominant.

Notes The overall species breakdown for planting in recent years, showing more clearly the trend to increased proportion of broadleaves, is in indicator A3.

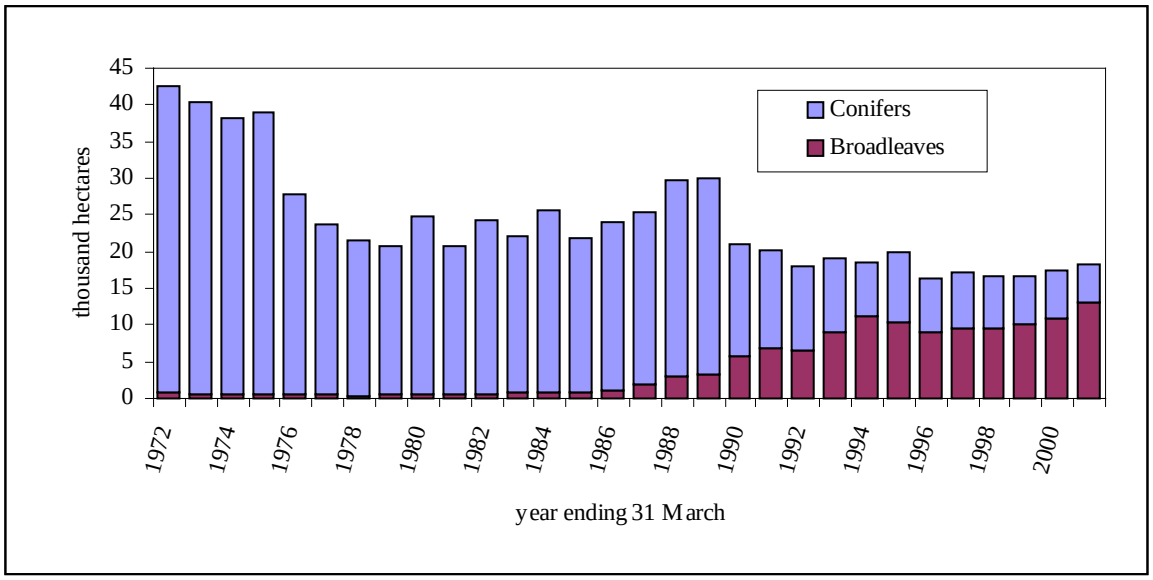
A3. New woodland creation

New planting – 5 year totals

thousand hectares

		5 year period ending 31 March					
		1976	**1981**	**1986**	**1991**	**1996**	**2001**
England	Conifer	18.3	7.0	5.3	3.9	3.2	3.2
	B'leaved	2.4	1.5	2.3	9.2	21.5	21.2
	Total	**20.7**	**8.5**	**7.5**	**13.1**	**24.7**	**24.4**
Scotland	Conifer	148.6	90.9	100.1	94.6	38.3	27.1
	B'leaved	0.6	0.8	0.9	9.2	21.0	28.5
	Total	**149.3**	**91.7**	**100.9**	**103.8**	**59.3**	**55.6**
Wales	Conifer	12.9	6.8	5.6	3.0	0.5	0.7
	B'leaved	0.1	0.2	0.3	1.1	2.0	2.1
	Total	**12.9**	**6.9**	**5.9**	**4.1**	**2.5**	**2.7**
N Ireland	Conifer	5.0	4.3	3.4	4.4	3.9	2.1
	B'leaved	0.1	0.3	0.4	1.0	1.4	1.5
	Total	**5.1**	**4.6**	**3.8**	**5.4**	**5.3**	**3.6**
UK	Conifer	184.7	108.9	114.3	105.8	45.9	33.0
	B'leaved	3.2	2.7	3.8	20.4	45.9	53.3
	Total	**188.0**	**111.7**	**118.2**	**126.3**	**91.8**	**86.4**

UK annual new planting of conifer and broadleaves



Planting on brownfield sites.

In 2000/1 there was a total of 189 hectares of planting on damaged or reclaimed land in the community forests.

A total of 23 hectares in 2000/1 and 15 hectares in 2001/2 (incomplete) has been recorded in WGS as woodland planted on brownfield sites.

A3. New woodland creation *cont.*

Key Points Around 700,000 hectares of new woodland was created in Britain during the last 30 years. Until the early 1990s, most was conifer woodland in Scotland. Since 1990, more than half has been broadleaved woodland.

Relevance New woodland creation contributes to the aim of expanding the woodland area to produce multiple benefits (see indicator A1).

Trend The average annual area of new conifer woodland has fallen from more than 30,000 hectares a year in the early 1970s to around 7,000 hectares a year in the 1990s. The average annual area of new broadleaved woodland has increased from around 600 hectares a year in the 1970s and early 1980s to around 10,000 hectares a year in the late 1990s.

Background This indicator does not explicitly show the main objective of the new woodland creation, although the conifer plantations mostly have timber as a main objective, while much of the new broadleaved woodland contributes mainly to environmental or social objectives. Brownfield sites are situated on degraded land in areas of high population, where environmental improvements can have a high impact. Planting of trees can be an inexpensive way of rehabilitating such land when compared with engineering solutions or built development. Regeneration of derelict land is indicator K1 in Quality of Life Counts.

Notes Data are for new woodland creation by FE plus grant-aided (excludes non-grant aided, which is estimated to total about 11,000 ha for 30 years).

A4. Loss of woodland

Data:

Loss of:
- Ancient semi-natural woodland (ASNW)
- Other semi-natural woodland (OSNW)
- Plantation

To:
- Agriculture
- Development
- Restoration of other habitats

A4. Loss of woodland *cont.*

Key Points This is a serious gap in our current information.

Relevance Woodland can be lost to agriculture, to development, or for restoration of special habitats and landscapes. For sustainable forestry, the first two reasons for loss would generally be viewed as undesirable, especially where the woodland has high environmental or social value, but the latter could be a positive indicator of forestry's wider environmental awareness. Overall, woodland loss counteracts new woodland creation, in attempts to increase woodland area. There are also particular concerns about loss of Ancient Semi-Natural Woodland, which is irreplaceable – see indicator B1.

Trend Views are widely divergent. Some suggest that there is little woodland loss, but the matrix of land-use change in DETR's Countryside Surveys suggested much higher levels.

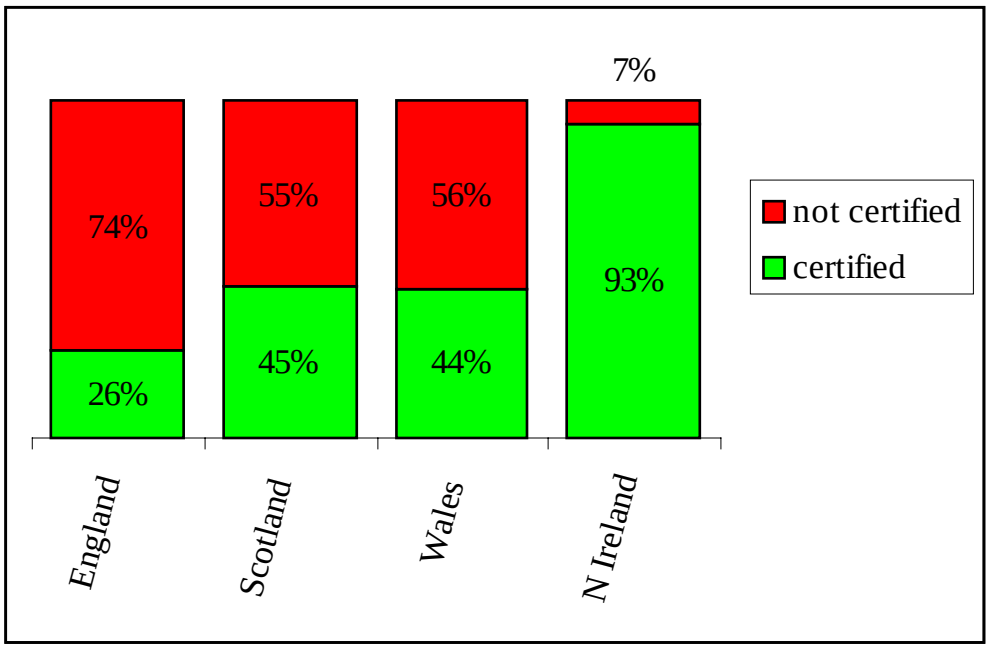
Background At present, there are no statistical systems to monitor woodland loss. In the future, the best single source could be repeated air photography, although this may not immediately show the successor land use. Other possible data sources include data from planning systems, data on land-use change, estimates from National Inventory of Woodland, and from 2000+ sample 1 km squares used for survey of Small Woods & Trees. In the future (but not as presently held) it may be possible to make use of WGS data on felling licences.

Notes Air photography could be available for all of GB on a 3-year cycle.

A5. Area of managed forest

Total area certified under FSC in December 2001

	England	Scotland	Wales	Northern Ireland	UK
Total forest area (000 ha)	1,100	1,317	289	83	2,790
Certified area (000 ha)	291	590	126	77	1,084
% certified	26%	45%	44%	93%	39%



It is proposed to further develop this indicator, by summing the following categories using GIS, to avoid double counting:

- Areas certified against the UKWAS or FSC UK standards by certification bodies accredited by UKAS (UK Accreditation Service) or FSC International
- Areas established with grant-aid since 1988
- Areas owned by conservation organisations if not already certified against UKWAS or the FSC UK standard
- Estimate for all other woodlands, based on National Inventory data for timber quality and any other relevant data

A5. Area of managed forest *cont.*

Key Points Over one third of the total UK forest area is currently certified as sustainably managed against the UK Woodland Assurance Standard or FSC UK standard. There is currently no wider measure of the total area managed.

Relevance This indicator measures progress on having an increased area managed sustainably. This can be demonstrated by certification to the UK Woodland Assurance Standard under the FSC or another scheme, or the FSC UK standard, but other areas are also managed sustainably. Certified forest is monitored to ensure that good management is continually in practice. There is also an interest in assessing the extent of positive management, even where it does not meet the standards for sustainability; this would require a supplementary indicator.

Trend The amount of woodland certified by the FSC scheme has been increasing since 1996 when the first woodlands came into the scheme.

Background The UK has two certification standards – UKWAS and the Forest Stewardship Council (FSC) UK Standard. They are recognised as equivalent, and certification against either is recognised by the FSC International scheme. A new scheme will soon be launched – the UK Certification Scheme for Sustainable Forest Management (UKCSSFM). It will use UKWAS. Certification is credible in the UK if it is carried out by a certification body accredited by UKAS or FSC International. The FSC began certifying woodland in 1996, and since then over 1 million hectares in the UK has received the certified status. This is over one third of the total forest area of the UK. The management practices in these woodlands are reviewed annually. Compliance with these standards is also an indirect measure of good management and protection of soils and water in the forest.

Notes Further information is available from the FSC website. Only one wood so far has been certified under the UKCSSFM. We hope to produce a digital map of all certified woodland in the UK with help from the certifying bodies as a first step towards developing this indicator. Organisations who are currently certified by FSC include Forest Enterprise (Scotland, England and Wales), Forest Service (Northern Ireland), National Trust, Woodland Trust, Crown Estate and various other wildlife trusts and private woodlands. When developed this indicator will also feature as indicator S12 in the Quality of Life Counts indicators of sustainable development.

A6. Area of each management type

Coppice area in GB 1995-99 (NIWT)

hectares

	England	**Scotland**	**Wales**	**GB**
Coppice	11,674	554	489	12,717
Coppice with standards	10,710	630	0	11,340
Total	**22,284**	**1,184**	**489**	**24,057**

The area of coppice woodland in the FC estate in 2001 is 1,359 hectares.

Other management types:
Require data for areas of woodland under the following management types;

- Clearfell
- Continuous cover
- Wood pasture
- Etc.

For TBFRA 2000, it was estimated that wood pastures total 20,000 hectares in the UK

A6. Area of each management type *cont.*

Key Points The area of coppice (including coppice with standards) is around 24,000 hectares, mostly in England.

Relevance It is desired to increase the area managed under "continuous cover" (alternative to clearfell), as it produces a more diverse age structure (of value to biodiversity) and may improve the landscape. There is also an interest in retaining areas of traditional management practices, including coppice and wood pastures.

Trend The area of coppice has declined, from 40,000 hectares in 1980 to 24,000 hectares in 1995-99. Time series of data are not available for other management practices.

Background Wood pastures include lowland parks, where scattered trees have been planted and allowed to grow very old, as well as other cultural landscapes (often including pollarded trees) and unenclosed upland areas.

Notes The FE database does not currently contain information about the management type of the woodland. However more information should be available later in 2002.

A7. Woodlands in landscape

Distribution of woodland size

	England	Scotland	Wales
All woodland			
Total area (thousand hectares)	1,097	1,281	287
% cover	8.4%	16.4%	13.8%
Woodland greater than 10 hectares			
Number of woods	14,334	6,393	3,001
Total area (thousand hectares)	842	1,201	241
Woodland between 2 and 10 hectares			
Number of woods	41,351	11,488	6,630
Total area (thousand hectares)	180	52	29
Small woods between 0.1 and 2 hectares			
Number of woods	166,776	64,525	23,405
Total area (thousand hectares)	75	29	17
Trees outside woodland (<0.1 hectares)			
*Tree density per km^2	684	245	738
Total length of linear features			
*Metres per km^2	736	239	702

* Numbers of trees and length of linear features were only estimated for the countryside, but the density is calculated by dividing this by the total surface area.

Additional data will be available from NIWT:

- Average block size / block size distribution
- Between-stand species diversity
- Between-stand structural diversity (vertical)

A7. Woodlands in landscape *cont.*

Key Points About a quarter of England's woodland area is in woodlands smaller than 10 hectares, compared with 16% for Wales and only 6% for Scotland. Trees outside woodland and linear features also contribute more to the landscape of England and Wales.

Relevance The overall landscape impact of woodland depends on the percentage woodland cover, and also on the extent to which it is broken up. Linear features and trees outside woodland also contribute to the landscape.

Trend Information on woodland size is not available from previous Woodland Censuses. In the future, changes may be able to be monitored every few tears by air photography and/or satellite imagery.

Background This draft indicator presents some information that is readily available from NIWT 1995-99, using the NIWT digital map to identify woodlands of 2-10 hectares. It is also important to show whether woodland is "in fitting" with the overall landscape, and also the extent to which the woodland design meets the landscape guidelines in the UK Forestry Standard.

Notes Forest Research have done some work to develop landscape indices which best describe the pattern and structure of the woodland landscape. This has been tested on some areas of FC woodland but could possibly be applied to wider areas of woodland in the UK (Ferris *et al*. 2001). Indices should also be available from follow-up work for the Countryside Survey 2000.

UK Indicators of Sustainable Forestry

B. Biodiversity

B1. Ancient woodland

B2. Native woodland

B3. Native woodland condition

B4. Richness of fauna

B5. Richness of flora

B6. Natural regeneration of woodland

B7. Diversity of woodland within a stand

B1. Ancient Woodland

Area of ancient and ancient semi-natural woodland in the UK

thousand hectares

	England	Scotland	Wales	Northern Ireland	UK
Total woodland	1,100	1,317	289	83	2,790
Ancient woodland[1]	341	148	61	?	550
ASNW (Ancient semi-natural woodland)[1]	206	89	31	3[2]	329
Restored native woodland on an Ancient woodland site					

[1]Source: Pryor and Peterken (2001) [2]Source: Forest Service database

Ancient woodland includes all woodland types on an ancient site. ASNW includes only semi-natural woodland on an ancient site.

B1. Ancient Woodland *cont.*

Key Points The area of ancient woodland in UK is now estimated to be 550,000 Ha, of which 326,000 Ha is Ancient Semi-Natural Woodland (ASNW). ASNW accounts for around 12 % of the total UK woodland area and around 1.4 % of the total land area.

Relevance A key target is to maintain the area of ancient woodland. Ancient semi-natural woodlands tend to be richer in plants and animals than other woodland areas, and also have a role in preserving locally native genotypes; they are also important as part of the historic landscape.

Trend The area of ASNW has declined over the centuries and the woodlands have become increasingly fragmented. Of the ancient semi-natural woodland present in the 1930s, about 38 % was converted to plantations and a further 7 % cleared for other land uses; depletion has now largely ended as policies for their conservation are implemented.

Background As there are not reliable records older than 1600 (1750 in Scotland), ancient woodlands are defined as areas that have been continuously wooded since 1600 or 1750 respectively. It is therefore impossible for the area to increase. Ancient woodland can be ancient semi-natural (ASNW) or plantations on ancient woodland sites (PAWS), which may retain some of the native trees, shrubs and ground flora. The removal of non site-native trees and restoration of native woodland on some of these ancient sites is a target under the UK Biodiversity Action Plan (BAP). Areas of ASNW are now highly fragmented; the greatest concentrations are in south-east England, the southern Welsh borders and the central Scottish highlands. Only about a quarter of ASNW is in designated nature conservation areas.

Notes The area of ASNW in GB is indicator S11 in the Quality of Life Counts indicators of sustainable development. There is no Ancient Woodland Inventory for Northern Ireland. In future we hope to be able to record the area of PAWS that is restored to native woodland on ancient woodland sites in the WGS and FE databases. No records of the loss of ancient woodland currently exist; this is dealt with in indicator A4.

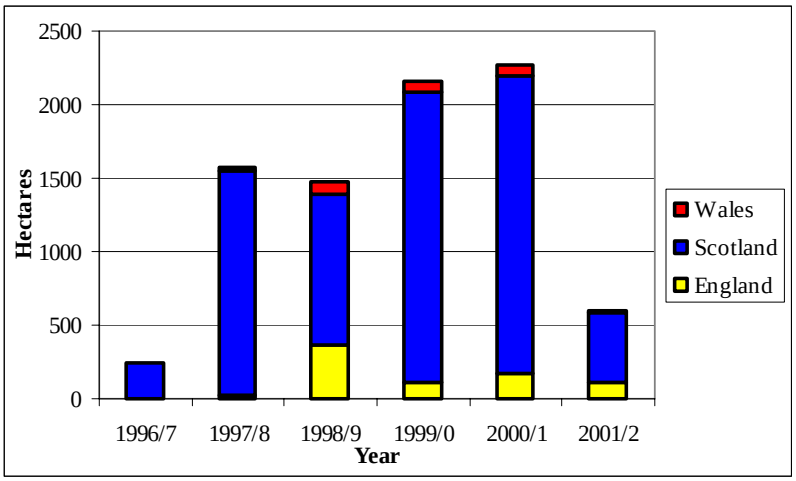
B2. Native woodland

Area of native woodland in the UK, the percentage which is of natural origin (not plantation), and the area of native woodland which is currently part of a Habitat Action Plan.

	England	Scotland	Wales	Northern Ireland[2]	UK
Total woodland (000 ha)	1,100	1,317	289	83	2,790
Native woodland (000 ha)		321[1]			
Native woodland which is natural origin (%)		47%[1]			
HAP Woodland (000 ha)		152			
Expansion of native woodland (Ha yr^{-1})					

[1] Source: MacKenzie (1999) [2]figures for NI are currently being produced

Area of 'new native woodland' where a WGS grant first instalment has been paid. 2001/2 is incomplete.



Other data:

- Could show instead the area of new native woodland where the second instalment has been paid.
- 'New native woodland' is likely to be an underestimate of the total amount of native woodland which is planted or regenerates naturally. Also hope to calculate the total amount of planting and regeneration of native species (native by region) in each country, including FC and non-FC woodland.

B2. Native woodland *cont.*

Key Points Almost one quarter of Scotland's woodland is native. Since 1988 a grant has been paid by the WGS for planting of new native woodland (new native pinewood since 1989).

Relevance Native woodland has a high value for biodiversity with a high concentration of rare and threatened species as well as many other environmental and cultural benefits including amenity, landscape and soil and water protection.

Trend The area of native woodland appears to be increasing, although the proportion of total woodland which is native has decreased. Work is ongoing to increase the accuracy of these estimates.

Background The total native woodland resource includes both natural origin native woodland and planted origin native woodland. 'New native woodland' is being created using communities of locally native tree and shrub species matched to the site (FC, 1998). It is intended that new native woodlands will increase the area of woodlands with semi-natural characteristics. Nature conservation and protection and enhancement of cultural landscapes are strategic objectives of management.

Notes The amount of native woodland in Scotland is estimated as 320,938 Ha in 1998 by MacKenzie (1999), of which 47 % is of natural origin. This is an apparent increase of 34 % over the five years from 1993. The 'New Native Woodland' planting only includes planting in non-FC woodlands in GB. It is a subset of the new woodland creation which is given in indicator A3. There are large uncertainties related to estimates of native woodland area and this indicator requires further work.

B3. Native woodland condition

Data:

- Condition of native woodland

Source:

- None at present. There is recognition that this is an important indicator, and condition measures are being developed by HAP working group

B3. Native woodland condition *cont.*

Key Points This is a gap in our current information.

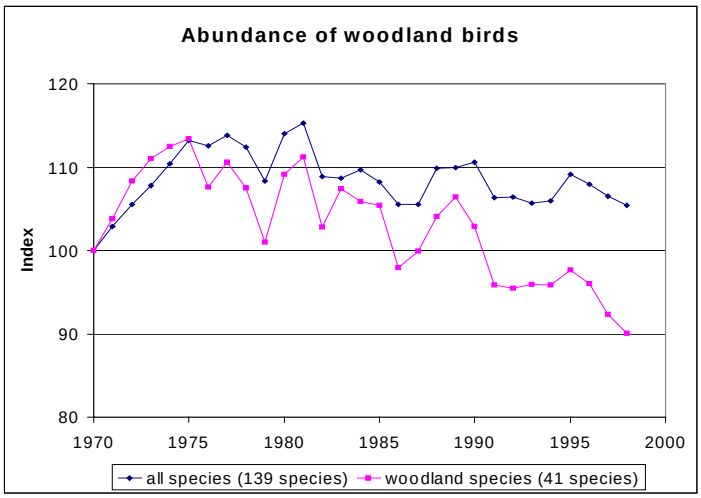
Relevance The condition of native woodland is important for the maintenance and management of biodiversity in the UK. Although there are measures of the area of such woodlands and the number of Habitat Action Plans (HAPs) in native woodland, there are currently no surveys of the condition of such habitats to see whether the management is having the desired effect.

Trend Not known

Background There will eventually be a HAP for all semi-natural native types in the UK. Plantation of native species being managed to develop their natural character would also be included. The aim of the HAPs is to set out specific targets for the conservation of each habitat and to list key actions that are necessary to achieve these objectives. Progress will need to be monitored at the strategic level (i.e. HAP type as a whole) as well as at the individual site level. A HAP working group is developing a measure of condition to be used throughout the scheme.

B4. Richness of fauna (birds, butterflies and mammals)

Abundance of all birds and woodland birds in GB since 1970. (source: DETR, 1999)



Other data:

- Abundance of butterflies at woodland sites
- Abundance of bats
- Abundance of mammals
- Index of woodland Species Action Plan (SAP) species abundance

Sources:

- Butterfly abundances (all species) at 44 woodland sites (15 coniferous, 29 broadleaved) are available from the Butterfly Monitoring Scheme. This will require some work to form an index, or similar. Woodland SAP butterflies are not numerous enough to form a GB index of their abundance.
- Bat box schemes are managed by each FE district. Basic annual information, including the number of boxes and number of species present, is collated by FR for the Eurobat project. It is uncertain whether there is sufficient information to form an indicator. Occupancy of the bat boxes does not show the bat population as a whole is increasing, or if the bats are moving from their more natural roosts.
- Mammonet, a monitoring network for mammals, is being developed for GB and it may be possible to use information about woodland mammals from this monitoring scheme.
- The 130 (fauna and flora) woodland SAP species will be monitored as part of UK Biodiversity Action Plan. Formation of an index of their abundance is desirable although will require considerable work and time. It may be possible to form an index of the abundance of the smaller group of 'woodland specialists', excluding species that are partially dependent upon woodland.

B4. Richness of fauna (birds, butterflies and mammals) *cont.*

Key Points Woodland birds are less abundant relative to general bird populations than they were in 1970 (but populations have not declined as much as farmland birds).

Relevance We value wildlife for its own sake and because it is an integral part of our surroundings and our quality of life. Maintaining sustainable woodland habitats means ensuring that there are no large changes in the characteristics of woodlands. Birds are regarded as good indicators of the broad state of wildlife and the countryside, because they are wide-ranging in habitat distribution and tend to be at or near the top of the food chain. Butterflies and bats are good indicators of diversity in young and mature woodland respectively. Present policy seeks to promote management which leads to a more diverse forest.

Trend Although populations of the more common woodland and farmland birds have been declining, populations of other birds, such as open water birds and many rare birds, have been stable or rising.

Background Maintenance and enhancement of biodiversity has become more important since the Rio summit in 1992. However it is very difficult to measure, because of the vast numbers of species. There are many factors affecting populations of birds and other wildlife species. These include short-term influences such as the weather and a range of longer-term influences such as changes in farming practices, loss of habitat diversity, urban development, road building, climate change, loss of habitats, changes to food supplies and pollution.

Notes The bird index forms one of the headline Quality Of Life Counts indicators of sustainable development. More information about individual bird species trends can be found on the RSPB website. Division of the bird and butterfly indices into England, Scotland, Wales and Northern Ireland will not be possible without increased monitoring.

B5. Richness of flora

Vegetation richness and condition scores in 1998 and their change since 1990 from CS2000

Broadleaf, mixed and yew woodland	1998 Score	Change 1990-1998
Species Richness Score	15.3	-2.1
Light Score	6.0	-0.07
Fertility Score	5.0	+0.09
Conifer woodland		
Species Richness Score	10.0	
Light Score	6.3	
Fertility Score	3.4	

* Broadleaf (Conifer) scores based on 195 (170) sample 'x' plots in CS2000 in GB. Broadleaf change scores based on the 131 plots which were in the same woodland broad habitat in 1990 and 1998. Higher scores indicate more species, and higher levels of light and fertility.

Data is available for Scotland separately and England and Wales combined. CS2000 did not contain sufficient monitoring plots in Wales for their results to be analysed separately.

B5. Richness of flora *cont.*

Key Points This indicator shows the overall condition and richness of flora in woodland.

Relevance We value wildlife for its own sake and because it is an integral part of our surroundings and our quality of life. Maintaining sustainable woodland habitats means ensuring that there are no large changes in the characteristics of woodlands. These indicators show trends in nutrient status, and hence whether management is delivering a stable mosaic of woodland types, even though there are natural changes and successions between types. Present policy seeks to promote management which leads to a more diverse forest structure in plantations

Trend

Broadleaved, mixed and yew woodland

From 1990 to 1998 in England and Wales, there was an overall decline in species richness, and an increase in the frequency of plant species associated with more nutrient-rich conditions (fertility score). There was also a change from species suited to well-lit conditions to those suited to more shaded conditions (decrease in light score). This change in light score is perhaps expected due to a 'successional' change (the woodlands established in 1990 will have developed, and longer established woodlands would have continued to mature), but it could also be due to changes in the nature and intensity of management.

Coniferous woodland

There was no significant change in the variety of vegetation types (species richness) between 1990 and 1998.

Background The scores in the table are based on plant species recorded in the CS2000 sample plots. Species richness measures the number of species found on each plot. This is a simple measure of plant diversity. The Light score is an indirect measure of light availability at ground level. It reflects changes in the abundance of plants that either tolerate or cast shade through to plants which grow on open ground. The fertility score is an indirect measure of soil fertility. It reflects changes in the abundance of plants that are known to be associated with different levels of nutrient availability. See Haines-Young *et al.* (2000) for further information.

Notes Scores quoted here are for GB. Some of these scores can be separated into 'Scotland' and 'England and Wales'. No similar samples were taken in Northern Ireland.

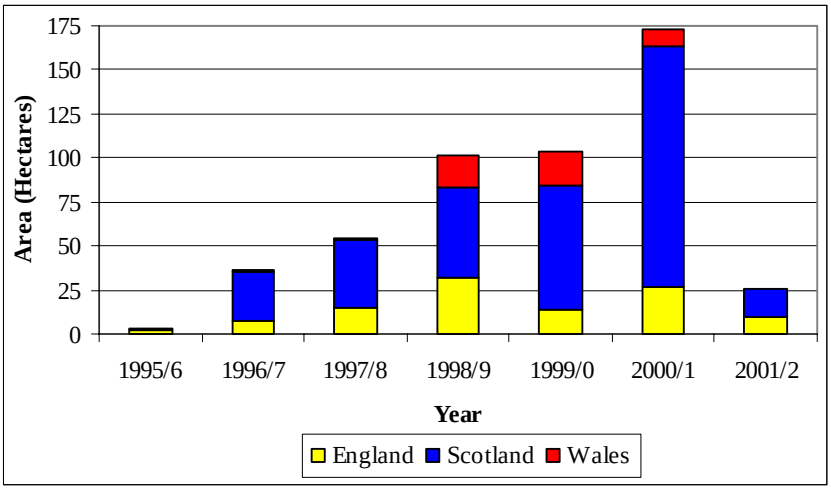
B6. Natural regeneration of woodland

Total amount of natural regeneration where the second instalment of the WGS grant is paid (includes natural regeneration of ASNW and other woodland types).

hectares

Year	Total Natural regeneration in GB	Natural regeneration of ASNW in GB
1994/1995	72	0
1995/1996	206	3
1996/1997	340	36
1997/1998	887	55
1998/1999	2,248	101
1999/2000	2,118	104

Area of natural regeneration of Ancient Semi-Natural Woodland where second instalment of the WGS grant is paid. Includes new woodland creation and restocking. 2001/2 is incomplete.



- Natural regeneration area is also available from the FE database for FC woodland, although the total amount is likely to be higher than recorded here; The total amount of natural regeneration recorded in the FE database to 2001 is England 61.5 Ha, Scotland 1391.0 Ha and Wales 0.0 Ha.

B6. Natural regeneration of woodland *cont.*

Key Points The amount of woodland which is allowed to regenerate naturally has been increasing in recent years. Grants are obtainable for natural regeneration under the WGS.

Relevance Natural regeneration is preferred to planting for semi-natural woodland on suitable sites, as it can maintain the diversity of genotype, species composition and structure, more easily.

Trend The amount of natural regeneration of ancient semi-natural woodland has been increasing in recent years.

Background Planting was the favoured method of creating new woodland for some time but now natural regeneration is becoming increasingly favoured, especially in ASNW as it preserves the genetic diversity of the ancient and natural forest. The WGS introduced a grant for natural regeneration in 1988, both for new woodland and restocking of woodland. The second instalment of the grant, or a fixed payment, is payable once the trees are established.

Notes The figures show the amount of natural regeneration which is recorded in the WGS database for non-FC woodland, including new woodland and restocking of woodland. New woodland creation is shown in indicator A2. These figures are likely to be an underestimate of the actual amount of natural regeneration occurring, since they do not include regeneration occurring in woodland glades or along forest rides. Natural regeneration is also recorded in the FE database for FC woodland.

B7. Diversity of woodland within a stand

Data: We will use NIWT data for this indicator. We would like to show the following;

- Deadwood (pieces/ha)
- Old forest growth (measure still to be defined)
- Within-stand species diversity (no of patches per sample square?)
- Within-stand vertical structure

B7. Diversity of woodland within a stand *cont.*

Key Points Data should become available during the first half of 2002.

Relevance In addition to preserving the quality of ASNW there is also considerable scope to enhance the biodiversity of other woodlands by encouraging the development of natural processes such as the buildup of deadwood. Deadwood is an important habitat for certain species. There is also a high degree of biodiversity associated with naturalness and variation in woodland structure.

Trend Previous censuses of woodland did not collect such data.

Background Many aspects could contribute to an indicator of diversity of the woodland itself (within a stand). We will use the National Inventory of Woodland and Trees (NIWT) data, where pieces of deadwood, age of the forest as well as the number of species and vertical layers within a stand. This information should be available in the first half of 2002.

Notes NIWT does not cover Northern Ireland, and there is no alternative source of similar data. Other measures of diversity may be available from follow-up analysis of CS2000 data.

UK Indicators of Sustainable Forestry

C. Condition of forest and environment

C1. Air pollutants

C2. Crown density

C3. Damage by fire and wind

C4. Other damage

C5. River habitat quality

C6. Soil chemistry

C7. Water quality

C8. Surface water acidification

C9. Water yield and stream flows

C10. Pollution incidents

C1. Air Pollutants

Data:

- Concentrations of gaseous sulphur dioxide (SO_2), nitrogen oxides (NO_x) and ozone (O_3) are measured at the 10 level II Forest Condition Survey (FCS) sites.
- The concentration above and below the forest canopy of several ions (NO_3^-, NH_4^+ and SO_4^{2-}) is also measured. This allows the calculation of deposition (dry and wet) of sulphates and nitrates to the forest canopy.
- A few other sites in the Environmental Change network (ECN) (incl. Alice Holt) and other monitoring schemes are also in forested areas and could be combined with the FCS results to show a more complete map of pollutant deposition to forests in the UK.
- It is possible to show modelled deposition to woodland in the UK (courtesy of CEH, Edinburgh) in 5km gridsquares from their model.

Work is ongoing with Forest Research to discuss the best measures to show for this indicator.

C1. Air Pollutants *cont.*

Key Points Deposition of sulpur, and oxidised nitrogen to a lesser extent, is declining at all sites in the UK including forest sites.

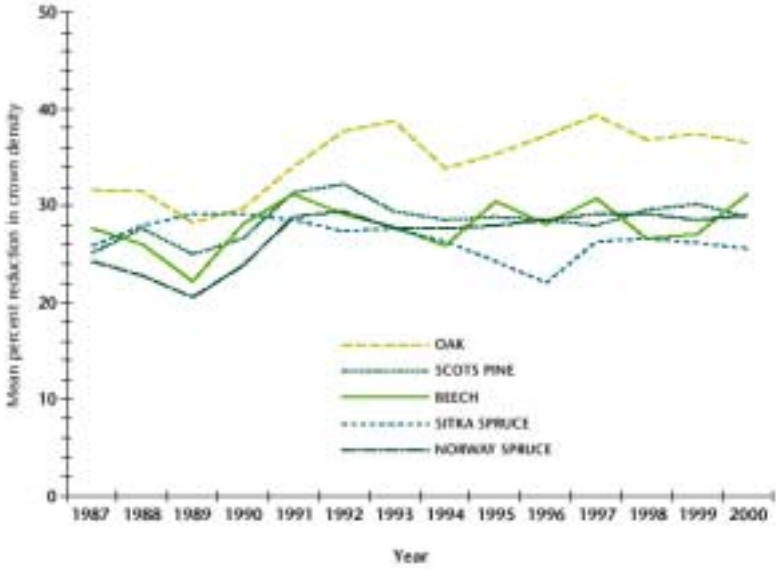
Relevance Changes in crown density of trees (see indicator C2) in the UK have not been linked to air pollution. However, other forest health parameters, such as the occurrence of insect damage and needle retention, have (NEGTAP, 2001). Air pollution may also predispose trees to the effects of drought and attack by fungi.

Trend Deposition of sulphur in the UK has declined by 50 % since its peak in emissions. A decline in deposition of oxidised nitrogen is also detected but it less marked (at 16 %). Ground level ozone peak concentrations have declined and are likely to continue to do so, but background levels are rising.

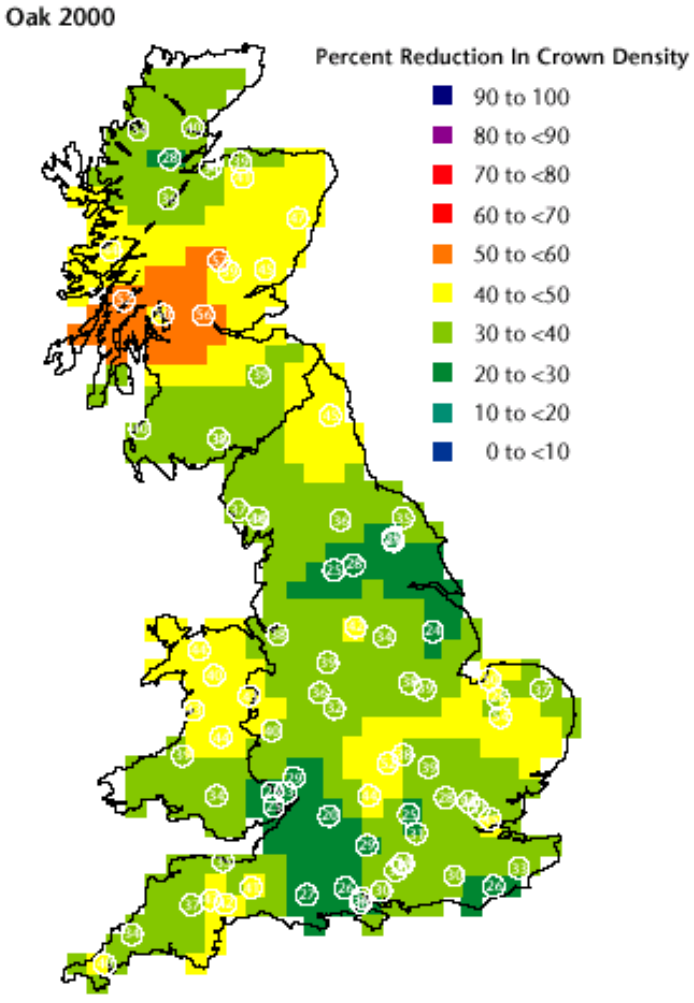
Background There are currently 10 Forest Condition Survey (FCS) 'level II' plots which are designed for more intensive monitoring than the 'level I' plots. Air quality and deposition has been monitored since 1995. FCS level II plots are mainly in FC forests. There may be one or two monitoring sites in other networks in private forest.

C2. Crown Density

Change in crown density of 5 species in GB. An upward gradient with time represents a deterioration in condition. Source: Hendry *et al.* 2001



Map showing the geographical variation of crown density for Oak in 2000. Areas with more healthy Oak are shown in dark green, and those in poorer condition are shown in orange. Source: Hendry *et al.* 2001



C2. Crown Density *cont.*

Key Points The condition of all species changed little between 1999 and 2000. Sitka spruce has improved slightly probably due to recovery from a severe attack by insects in 1997. Oak was in slightly better condition in 2000 than any year since 1995, but is still in poor condition in central Scotland, north-east England, south-west England, Wales and East Anglia. Beech condition declined significantly in 2000.

Relevance Sustainable forest management requires the forest itself to be in good health. 'Crown density' is an overall measure of tree condition, indicating the amount of foliage on a tree.

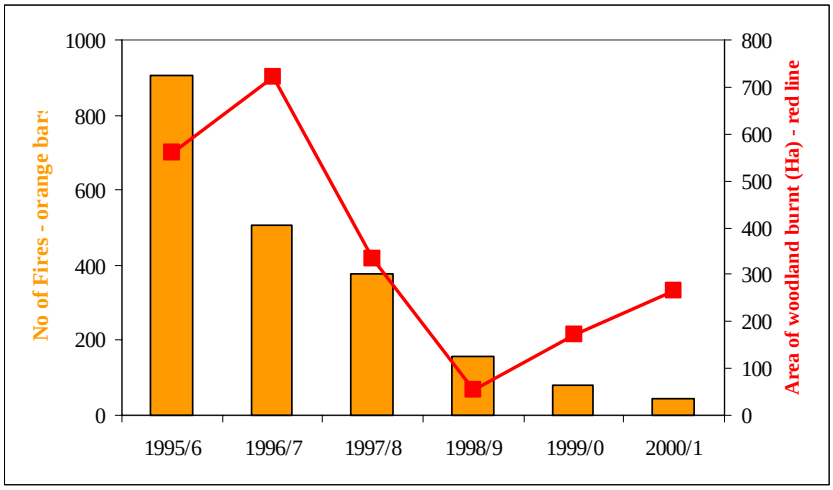
Trend There was a trend of gradual improvement in Sitka Spruce from 1989 to 1996, but annual changes are not statistically significant. Beech however shows statistically significant and marked changes from year to year. Both Norway spruce and Oak experience a gradual statistically significant deterioration from 1987-2000.

Background Crown Density is measured as part of the Forest Condition Survey (FCS). Since 1987 the FC has annually re-assessed 5 species in plots distributed throughout Britain. In 2000 it assessed a total of 8,376 trees in FC and private woodland on a total of 349 plots. The density of the tree crown is measured relative to an 'ideal' tree with full (100 %) foliage, hence 'reduction in crown density' is taken as a departure from the ideal. It is important to realise that such reductions are not necessarily due to ill-health. In some years, heavy flowering or seed-set for example can lead to marked reduction in foliation.

Notes Further information can be found in Hendry *et al.* 2001. There are only 3 Sitka Spruce plots in NI and they are not yet represented here.

C3. Damage by fire and wind

The number of fires (orange bars), with the total area burnt (red line) in the UK on FC and FS land



Summary information of catastrophic storms affecting Great Britain since 1945. (36 m s^{-1} = 130 km h^{-1}) Source: Quine *et al.* (1995)

Date of storm	Area affected by 36 m s^{-1} gusts (Ha)	Max. gust recorded (m s^{-1})	Volume of windthrown timber (million m^3)	Growing stock windthrown in affected area (%)
31 January 1953	37,000	50	**1.80**	**10-25**
15 January 1968	51,000	52	**1.64**	**15-30**[b]
2 January 1976	89,000	47	**0.96**	**<5**
16 October 1987	22,000	51	**3.91**[a]	**13-24**
25 January 1990	69,000	48	**1.26**[a]	**1-3**

a: known to include non-woodland trees
b: percentage of crops aged 31 years and over

C3. Damage by fire and wind *cont.*

Key Points Fire damage is not a serious problem in the UK, unlike some other European countries. Prediction and prevention of wind damage are important elements of forest management.

Relevance There is very little natural fire. Wind damage is a serious threat to managed forests because it results in loss of timber yield, landscape quality and wildlife habitat.

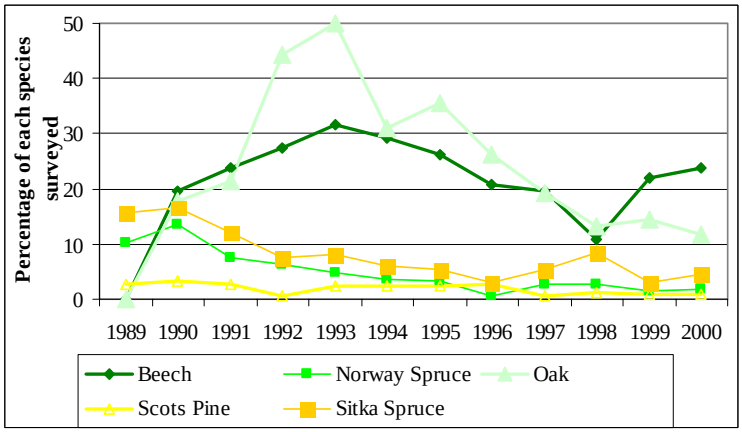
Trend In 2000/1 there were 47 fires reported to occur on FC/FS land in the UK. This resulted in a total of 266 Ha being burnt. The number of fires has decreased over the last few years. The area burnt decreased from 1996 to 1998, although it has increased since then. Wind damage is sporadic and occurs when large storms affect the UK. Both fire and wind damage are likely to be controlled by the climate to a high degree (e.g. 1995 was a drought year and suffered from many more fires than recent years).

Background A large proportion of the fire damage reported here is due to arson or simple carelessness of woodland visitors. Windthrow (where both stem and roots of the trees overturn) is the most common form of damage. Wind damage normally occurs during a large storm. Some damage tends to occur around once every three years. Major damage caused by the most catastrophic storms is shown in the table.

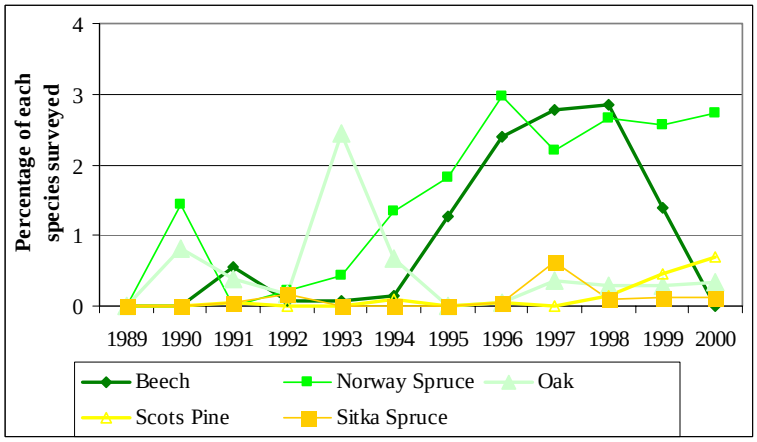
Notes Information on fires is only available for FC/FS forest. Since there is less public access to private woodland (See indicator E2), it is anticipated that fire damage is less of a problem than in FC woodland. One possible source for the number of fires in private woodland is from the Fire Service. Areas damaged by wind are for FC and private woodland.

C4. Other damage

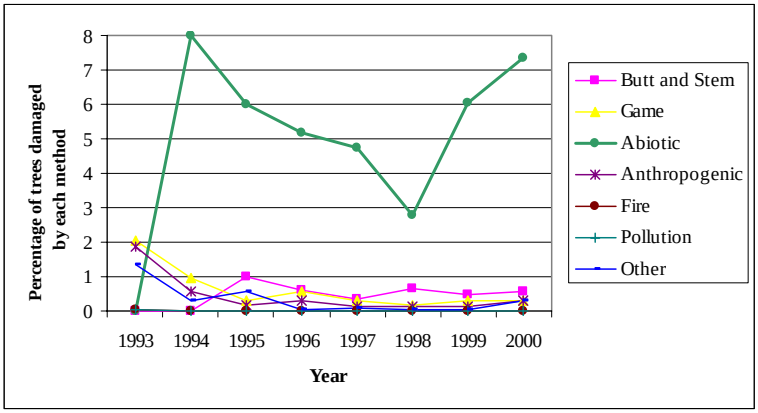
Common or abundant damage by insects recorded in the FCS



Common or abundant damage by fungi recorded in the FCS



Damage by other methods (rare, infrequent, common or abundant damage) of all species recorded in the FCS



C4. Other damage *cont.*

Key Points The main causes of damage reported in the FCS are damage by insects and fungi.

Relevance Crown density (Indicator C2) gives an overall measure of forest condition. These indicators assess the underlying reasons for lack of condition of some trees.

Trend The total number of trees affected by insects has decreased throughout the 1990s. The number of trees with abiotic damage has increased since 1998. Damage by other causes remains small.

Background These damage scores are measured as part of the Forest Condition Survey (FCS). Since 1987 the FC has annually re-assessed 5 species in plots distributed throughout Britain. In 2000 it assessed a total of 8,376 trees on the FC estate on a total of 349 plots. These scores represent the percentage of trees of each species that were affected. Oak has suffered particularly by insect damage, although this has been less of a problem since 1997. Beech also suffered from insect damage in 1999, especially in Scotland. Beech trees are regularly attacked by the beech leaf miner (*Rhynchaenus fagi*), but the actual damage to the health of the tree is only slight. However, attacks of the green spruce aphid (*Elatobium abietinum*) on Sitka Spruce can severely damage the health of the tree and the effects are long-lasting. Such an event occurred in 1997. Norway spruce plots in north England, Scotland as well as south west England, suffered from fungal damage.

Notes More information can be found in Hendry et *al.* 2001. Butt & Stem damage indicates where the bark of a tree has been damaged or lost. This damage could have occurred in a number of ways. Abiotic damage includes damage by frost and wind. Data for Northern Ireland is not yet shown here.

C5. River habitat quality

Data:
We aim to show the following two measures;

- River habitat quality
- Area/length (and condition) of riparian woodland (woodland along river and stream banks)

Habitat Quality:

- The River Habitat Survey (RHS), carried out by the Environment Agency (EA) and Scottish Environmental Protection Agency (SEPA), measures 'habitat quality' on selected stretches of UK rivers. We hope to be able to extract the information for wooded sites and possibly use a habitat modification score to assess change. The initial RHS was undertaken during the 1990s and involved over 5,000 sites across the UK.
- CS2000 has several stream bankside plots in broadleaf and conifer woodland. Several scores of vegetation condition are calculated similar to those shown in indicator B5. The 1990-1998 change in condition has been calculated for 230 broadleaf plots. Measures include soil moisture, light score, competitor score, stress, ruderal score, vegetation species richness and butterfly food scores.

Riparian woodland (woodland along river and stream banks):
There is no information currently held in the WGS or FC databases about riparian woodland. Neither are riparian zones identified in NIWT. It may be possible to include a riparian marker in future national inventories to allow separate analysis of riparian woodland plots.

The possibilities of identifying the length of riparian woodland within a GIS system are being investigated for FE woodland, and for all woodland with the NIWT digital map. It should be possible to identify the following for the FE woodland;

- Area of FC woodland within 50m, say, of a watercourse
- A breakdown of landuse types within this riparian zone
- A breakdown of species present within this riparian zone

Maps of these riparian zones would also be available.

C5. River habitat quality *cont.*

Key Points Data has not yet been extracted for this indicator.

Relevance The UK Forestry Standard and FC Guidelines recognise the high value of the riparian zone for nature conservation, landscape and recreation, and the key role that it plays in protecting the freshwater environment. Forest management should aim to maintain about half the length of streams open to sunlight by creating a mix of mainly broadleaved woodland and open space in the riparian zone. The condition of riparian and river habitat is an important indicator of the overall quality of the aquatic environment, while the length of riparian woodland is a useful measure of progress in restructuring the riparian zone.

Trend

Background Past planting of conifers close to streams resulted in dense shading and the loss of herbaceous riparian and aquatic vegetation. This reduced the biodiversity and productivity of streams and led to increased bank erosion. The felling of first rotation stands presents an important opportunity to reverse these and other effects through restructuring the riparian zone. The wetness of riparian soils and characteristic instability of stream banks mean that the zone is very sensitive to disturbance. Management must aim to protect the zone from the potentially damaging effects of forest operations on the adjacent land. The RHS involves a detailed description of the physical features of the river corridor. This information can then be used to assess the extent of change or damage over time. It may be possible to adapt the habitat modification scoring system that has been developed by SEPA.

C6. Soil chemistry

Data:

- pH, organic carbon, nitrogen, base saturation

Sources:

- National Soil Inventory measured pH and organic carbon, in the early 80's. There were 483 forested sites in England and Wales, 209 coniferous, 274 broadleaves. Scottish data is currently being analysed to assess the number of plots in woodland. Sampling included uppermost 15cm of mineral soil or peat.
- Hydrogen ion concentration (pH), nitrogen content (g kg^{-1}), organic carbon (g kg^{-1}) at 0-5, 5-10 and 10-20 cm depths were measured in 67 FCS Level I plots in 1995. GB only.
- Aim to include future monitoring of such variables in line with EA Soil Indicators (Loveland and Thompson, 2001), including pH, nitrogen, organic carbon and base saturation.

pH and soil organic carbon are among the Environment Agency's recommended 'minimum indicator set'. Nitrogen is also included in their list of biological soil indicators. Forest Research have been working with the Environment Agency on the development of a set of soil indicators and hope to include future measurements of soil condition in forests within this framework.

C6. Soil chemistry *cont.*

Key Points The individual datasets have not yet been compiled for this indicator

Relevance pH: The acidity or alkalinity of soil influences its interaction with substances which are added to it. Crop yields, water quality, habitat diversity are all related to the underlying pH of the soil.
Soil organic carbon: Soil organic carbon is an important indicator of a number of soil functions and related processes. It is related to the yield of food and fibre, the range and composition of soil-related habitats, among others (Loveland and Thompson, 2001).
Nitrogen: A broad indicator of fertility. Coupled with organic carbon, it has some potential to define nitrogen mobility and potential risk of loss in soil solution.
Base saturation: An important indicator of base status. Indicates the 'reserves' left in the soil to buffer against further additions of, for example, acidifying substances.

Trend

Background Forestry is often beneficial or neutral for soils, but can have a negative impact in some situations. Examples of damage are drying of peat, acidification and damage from forestry operations – the last includes disturbance, erosion and compaction from harvesting, cultivation and road building. There have been very few national soil measurements. In the early 1980's the National Soil Inventory made measurements including pH and organic carbon at over 6,000 sites around GB. In 1995, soil condition was measured at 67 FCS level I plots. These measurements are due to be repeated in 2005. Soil chemistry is measured continuously as soil solution at 7 FCS level II plots.

C7. Water quality

Data:

- Diversity and abundance of benthic invertebrates.

Source:

The EA and SEPA regularly survey benthic invertebrate populations in a large number of streams and rivers across the UK. Data are also available for some of the RHS sites. We hope to be able to extract the information for the relevant forest sites.

The diversity and abundance of the benthic invertebrate population at any given site can be compared to that expected on the basis of the natural physical habitat features using RIVPACS (River InVertebrate Predection And Classification System). This should highlight any physical or chemical impacts resulting from forestry operations.

C7. Water quality *cont.*

Key Points Data for this indicator has not yet been compiled

Relevance The protection of the freshwater environment is a key requirement for sustainable forestry. Most forest operations can affect the quality and quantity of drainage waters and the FC's Forests & Water Guidelines provide advice on best management practices for protecting and enhancing the water resource. The benthic invertebrate community integrates a range of chemical and physical impacts and thus provides a good measure of the health of the freshwater environment.

Trend unknown

Background Poor forest management can lead to increased soil erosion, greater water turbidity, nutrient enrichment and sedimentation within watercourses. These can pollute water supplies and damage wildlife and fisheries. Chemical monitoring can often miss polluting events, which are frequently of short duration and related to adverse weather conditions. In contrast, the benthic invertebrate fauna remains exposed to all perturbations and provides a better indicator of site disturbance. A wide range of biological scoring systems and indices based on the abundance and diversity of benthic invertebrates have been developed as a means of assessing ecological quality and the impact of water pollution. This work has been facilitated by the development of the River In Vertebrate Prediction And Classification System (RIVPACS), which uses information on physical habitat characteristics to predict the type of benthic community that could be expected at an unimpacted site. An assessment is based on sampling the benthic invertebrate fauna present in a stream, identifying to species or family level, and counting the number of individuals.

C8. Surface water acidification

Data:

- Acid Neutralising Capacity (ANC), pH, or aluminium

Various acid water monitoring networks:

- 12 sites (10 forest, 2 moorland) in upland Wales, monitored since 1991 (FC/ EA)
- 22 sites (5 forest) in UK Acid Waters Monitoring Network (UKAWMN), monitored since 1988 (See Monteith and Evans, 2001)
- 3 / 4 sites (forest and moorland) at Lynn Brianne, Wales, monitored since early 1980's (EA)
- 2 sites (forest and moorland) at Loch Dee, Galloway (SEPA), monitored since early 1980's
- 7 sites (6 forest) at Loch Ard (Freshwater Fisheries Laboratory (FFL)), monitored since late 1970's
- 2 sites (forest and moorland) in NW Scotland, monitored since 1983 (FFL)
- 2 sites (forest and moorland) at Halladale in north Scotland, monitored since 1993 (FC)

Aim:

We hope to be able to compare long-term trends in ANC for a select number of acid sensitive moorland and forest streams. This will give a measure of how forestry affects the expected recovery in water quality in response to continued reductions in pollutant emissions. Alternative measures include the use of pH or aluminium concentration.

C8. Surface water acidification *cont.*

Key Points The individual datasets have not yet been brought together to form this indicator.

Relevance Acidification remains a serious problem in a number of areas of the UK. The primary cause is the deposition of acidic sulphur and nitrogen compounds derived from the combustion of fossil fuels. Forest canopies can significantly increase the capture (scavenging) of some of these pollutants in the atmosphere. This has led to concern that forestry may contribute to further acidification in sensitive areas or delay recovery in response to ongoing emission reductions.

Trend

Background A number of long-term studies have been established to monitor the response of acidified streams to ongoing reductions in emissions of acid pollutants. Some of the studies involve forested catchments to determine the magnitude of the forest scavenging effect and to assess how this will affect the recovery process. Acid neutralising capacity provides the most robust measure of acid status. It is proposed that the annual mean ANC data for 4 or 5 forest streams will be combined for each of Wales and Scotland and the trend compared with that from an equivalent number of moorland sites. Alternatively, the moorland data could be subtracted from the forest and the difference between the two plotted.

Notes Much work has been completed on the effect of forestry on the recovery of streams from acidification in Scotland by Harriman *et al.* (2001). This and other work will be considered in the development of an appropriate indicator.

C9. Water yield and stream flows

There are 3 long-term catchment studies in GB which consider the effects of forestry on water yield and river flows;

- Coalburn, nr Kielder, north England (Robinson *et al.*, 1998)
- Balquhidder, mid Scotland (Johnson, 1991)
- Plynlimon, mid Wales (Kirby *et al,* 1991)

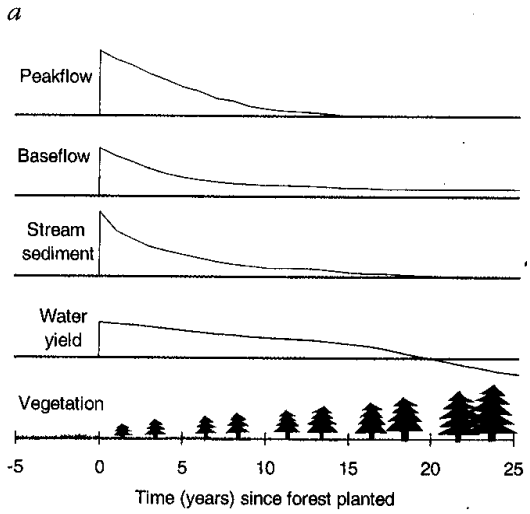
Measurements include precipitation and stream discharge, covering various stages of forest development and growth. The record for Plynlimon extends back to the mid 1960's and spans the period from forest establishment to clearfelling and restocking. Balquhidder has the shortest record, starting in 1981, and covers the effects of clearfelling and restocking. Coalburn is the only site to include a baseline period of measurements when the catchment was under moorland; the record covers afforestation in 1972 and the subsequent growth of the crop to 30 years age. Both the Plynlimon and Balquhidder studies include neighbouring moorland control sites, although the one at Balquhidder has now been partly afforested.

With this information we can assess the effect of the complete forest cycle on;

- Catchment water yield
- Peak/flood flows

Summer low flows

Summary of main hydrological changes at Coalburn over time as the forest is planted and grows. Source: Robinson *et al.* (1998).



C9. Water yield and stream flows *cont.*

Key Points The individual datasets still need to be brought together to formulate this indicator.

Relevance Water yields from catchments containing closed canopy conifer forest may be less than from moorland or grassland catchments due to their greater interception loss. This loss increases with forest height and canopy development and is greatest in the wetter, upland areas of Britain. Overall, research suggests that there may be some 1.5-2.0% reduction of potential water yield for every 10% of a catchment under mature forest. There are also concerns that summer low flows will be reduced, while peak flows could be lowered or increased, depending on the scale and nature of forest practices.

Trend This figure is a schematic diagram which explains the trends in water yield and peak and low flows that have occurred since afforestation of the Coalburn catchment in 1972.

Background Catchment studies were established in 1967 at Coalburn in north England and Plynlimon in mid Wales, and in 1981 at Balquhidder in mid Scotland, to quantify the hydrological effects of forestry in upland Britain. These cover different phases of the forest cycle, from pre-planting cultivation and drainage, through establishment and forest growth, to eventual harvesting and restocking. Monitoring is continuing to enable the results for each phase to be compared between sites, as well as to assess the effects of forest restructuring and the second rotation on catchment hydrology. It is proposed to plot the annual run-off and indices of low and high flows to identify the presence of any trend. Background variation in weather patterns will be removed using the data from neighbouring moorland control catchments.

C10. Pollution incidents

The number of water pollution incidents due to forestry and logging compared with the total number due to agriculture[5]

	England & Wales[1]		Scotland[2]		N. Ireland[3]		UK
	Forestry	% Agric	Forestry	Total Agric	Forestry	% Agric	
1993	1	0.0					
1994	20[4]	0.6					
1995	20[4]	0.7					
1996	15[4]	0.7					
1997	31	1.6					
1998	23	1.1		425	0		
1999	77	1.8		361	0		
2000				380	0		

[1]Source: EA (1999) and previous years; [2]Source: SEPA website. Data for financial years 1998/9 and 1999/2000 and 2000/1; [3]Source EHS; [4] Figures are estimated from graph; [5]'agriculture' includes all types of farming (incl. fish farming) and forestry.

Also available from the EA is the number of breaches of legislation which have resulted in prosecution in England and Wales, for the forest industry and for agriculture as a whole. This information should also be available for Scotland and Northern Ireland.

C10. Pollution incidents *cont.*

Key Points In 1999 there were 77 substantiated pollution incidents due to Forestry and logging in England and Wales.

Relevance The UK forestry standard states that all forestry operations should be carried out to minimise disturbance to watercourses and avoid pollution and siltation. This is a measure of the pollution events reported to the relevant authorities, and is not compared with any measure of the level of activity that could potentially cause such pollution events.

Trend

Background Both the EA and SEPA keep a record of the reported water pollution incidents. These are categorised as major (1), significant (2), minor (3), and no impact (4). In 1999 in England and Wales, there were a total of 36,623 reports of pollution incidents, and 14,374 were substantiated. Pollution incidents due to forestry and logging account for 1.8 % of substantiated agricultural pollution events, and 0.5 % of the total number of substantiated pollution events. Environment and Heritage Service (EHS) are not aware of any pollution events due to forestry and logging in Northern Ireland in recent years. FS management met with EHS to discuss pollution prevention and have detailed pollution prevention guidelines in place for their staff and contractors.

UK Indicators of Sustainable Forestry

D. Timber and other forest products

D1. Volume of growing stock

D2. Harvesting compared with annual increment

D3. Timber production and future availability

D4. Home-grown as % of consumption

D5. Carbon storage

D6. Economics of forestry

D7. Value added in wood processing

D1. Volume of growing stock

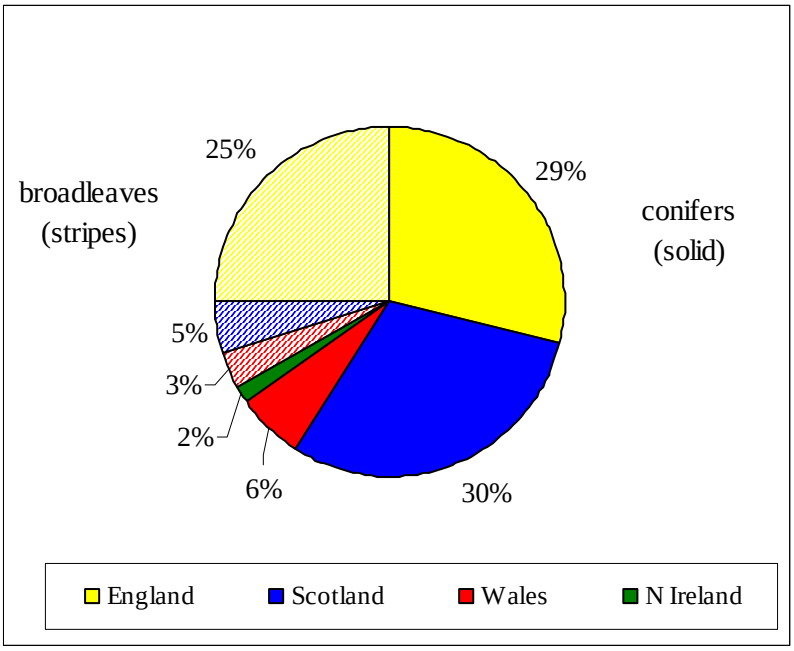
This is a summary of data compiled in 2001 for the European Forestry Sector Outlook Studies. It only covers growing stock of timber quality (and Northern Ireland is FS only). Revised figures will be available in February/March 2002 covering a wider definition.

Volume of growing stock and gross annual increment

	Conifers			Broadleaves		
	Area (thousand hectares)	Growing stock (million m^3)	Annual Increment (million m^3)	Area (thousand hectares)	Growing stock (million m^3)	Annual Increment (million m^3)
England	434	102	4.3	510	88	3.3
Scotland	891	107	10.1	109	17	0.7
Wales	145	21	1.8	61	12	0.4
N Ireland	51	6	0.6	2	0	0.0
UK	**1,521**	**236**	**16.8**	**682**	**117**	**4.4**

Note: Based on NIWT data for 1995-1999.

Proportion of growing stock which is conifer/broadleaved and the proportion in each country in the UK



D1. Volume of growing stock *cont.*

Key Points The total growing stock of potential timber is around 350 million m^3, of which two-thirds is conifers (softwood). On average, the conifers are growing by around 7% a year, and broadleaves by around 4% a year.

Relevance An increased volume of growing stock provides a reserve of timber for future use by wood processing industries.

Trend Growing stock is increasing over time, as annual increment exceeds the volume harvested – see indicator D2.

Background These estimates are based on the National Inventory of Woodland & Trees for 1995-99, broken down by species group and age band, using assumptions about conifer yield classes consistent with the forecasts in D3.

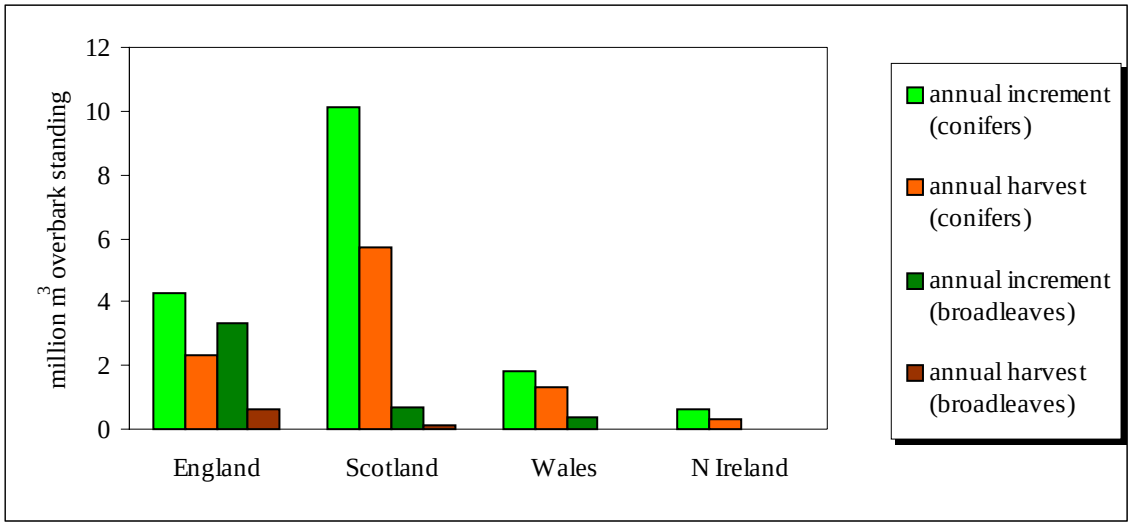
Notes Volumes were adjusted from UK definitions (7 cm minimum diameter including stump) to be consistent with the internationally agreed definitions for the Forest Resources Assessment (0 cm minimum diameter, excluding stump)

D2. Harvesting compared with annual increment

Comparison of annual increment and 2000 harvest volumes in the UK

Million m^3 overbark standing (to 0 cm minimum)

	Conifers		Broadleaves	
	Annual Increment	Harvest 2000	Annual Increment	Harvest 2000
England	4.3	2.3	3.3	0.6
Scotland	10.1	5.7	0.7	0.1
Wales	1.8	1.3	0.4	0.0
N Ireland	0.6	0.3	0.0	0.0
UK	**16.8**	**9.6**	**4.4**	**0.7**



D2. Harvesting compared with annual increment *cont.*

Key Points The annual volume of conifer (softwood) timber harvested is around 60% of the gross annual increment in conifer growing stock. The volume of broadleaves (hardwood) harvested is only around 20% of the gross annual increment in broadleaved growing stock.

Relevance This is an indicator of the sustainability of timber production over time. For long run sustainability (maintaining the volume of growing stock), the gross annual increment in growing stock must exceed the volume harvested. The difference must be at least enough to cover the volume of unrecovered natural losses (e.g. fire) and the volume of unrecovered timber left after harvesting; these losses are not recorded in UK statistics, but are both estimated to be relatively small.

Trend The volume harvested each year is increasing, as new plantations created in the 1950s to 1970s are approaching the end of their first rotation. For a similar reason, annual increment is also increasing (but less slowly), as these plantations are in a period of rapid volume growth during the years before harvesting. Harvesting as a % of annual increment is likely to rise, but should remain below 100% because of the continuing (slower) increase in woodland area, and the increased extent of areas of long term retention.

Background Other European countries have similar ratios of harvesting to increment (e.g. Germany is around 55%, France around 65%) while Sweden and Finland are both around 75%. This is one of the Environmental Indicators adopted by the UN Commission on Sustainable Development and included in the Eurostat pilot Indicators of Sustainable Development in 1997 (ENV18 – Wood Harvesting Intensity).

Notes

D3. Timber production and future availability

Timber production in Great Britain

thousand m^3 overbark standing

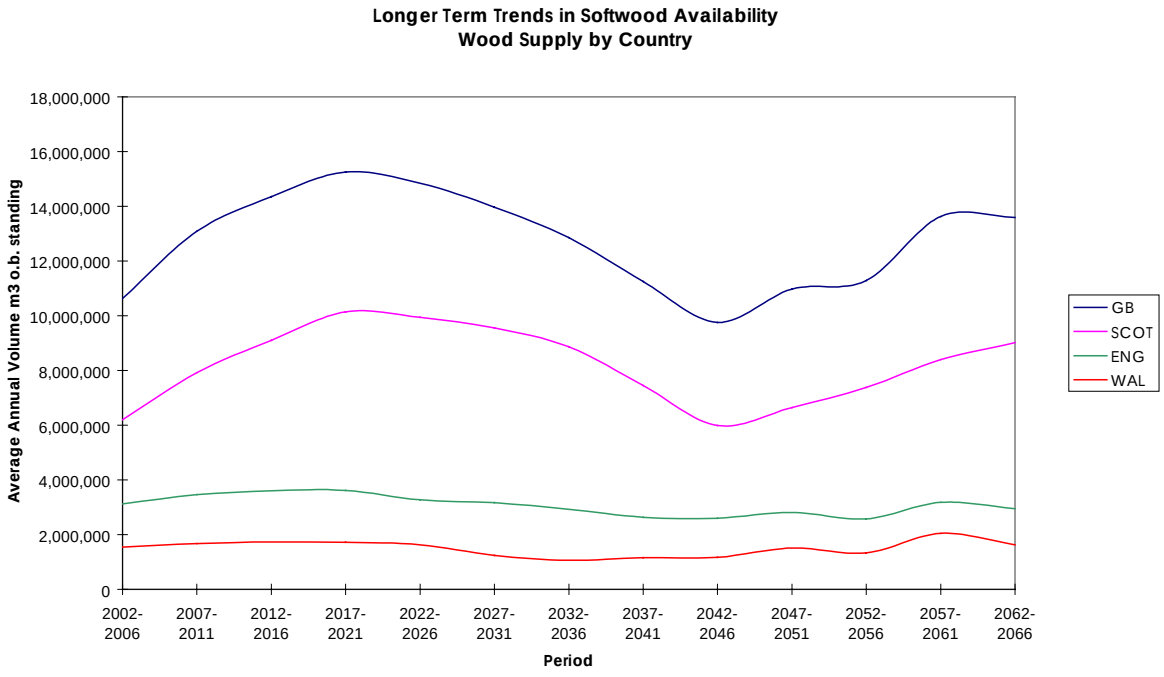
Year	Softwood			Hardwood	Total (GB only)
	Forestry Commission	Private woodland	Total softwood		
1970	1,490	900	2,390	1,300	3,690
1980	2,410	980	3,390	1,300	4,690
1990	3,460	2,200	5,660	1,120	6,780
2000	5,530	3,780	9,310	740	10,050

Future availability of timber in Great Britain

thousand m^3 overbark standing

annual average in the five years:	Softwood			Hardwood	Total (GB only)
	Forestry Commission	Private woodland	Total softwood		
2002-2006	5,130	5,750	10,870	1,000	11,870
2007-2011	5,980	7,080	13,060	1,000	14,060
2012-2016	6,240	8,200	14,450	1,000	15,450
2017-2021	6,850	8,630	15,480	1,000	16,480

Longer term trend in softwood availability for Great Britain



D3. Timber production and future availability *cont.*

Key Points Total softwood availability is forecast to increase over the next 20 years, providing more raw material for UK wood processing industries.

Relevance The softwood forecast shows that the current woodland area can provide raw material for a larger processing industry, but the decline after 2020 may make it difficult to establish long-term industries. For hardwood, future availability is less of an issue; there is a large volume of over-mature timber which could be harvested, but only a small number of suitable markets for this product.

Trend The annual volume of softwood harvested in GB, has increased steadily from 2.4 million m^3 in 1970 to 3.4 million m^3 in 1980, 5.6 million m^3 in 1990 and 9.3 million m^3 in 2000. Availability is forecast to increase by more than 60% to 15.5 million m^3 around 2020, but then fall back to little more than the current level by 2050. Hardwood figures are based on the assumption that production will remain at current levels in the foreseeable future, and not based on availability.

Background Forecasts for the private sector are based on the woodland areas in NIWT 1995-99, using assumptions about average yield classes, rotation lengths and other parameters agreed with advisory groups representing woodland owners and wood processors. Forecasts for the Forestry Commission were provided by the planning systems of Forest Enterprise.

Notes

D4. Home-grown as % of consumption

Volume of imports, exports, and homegrown wood and wood products;

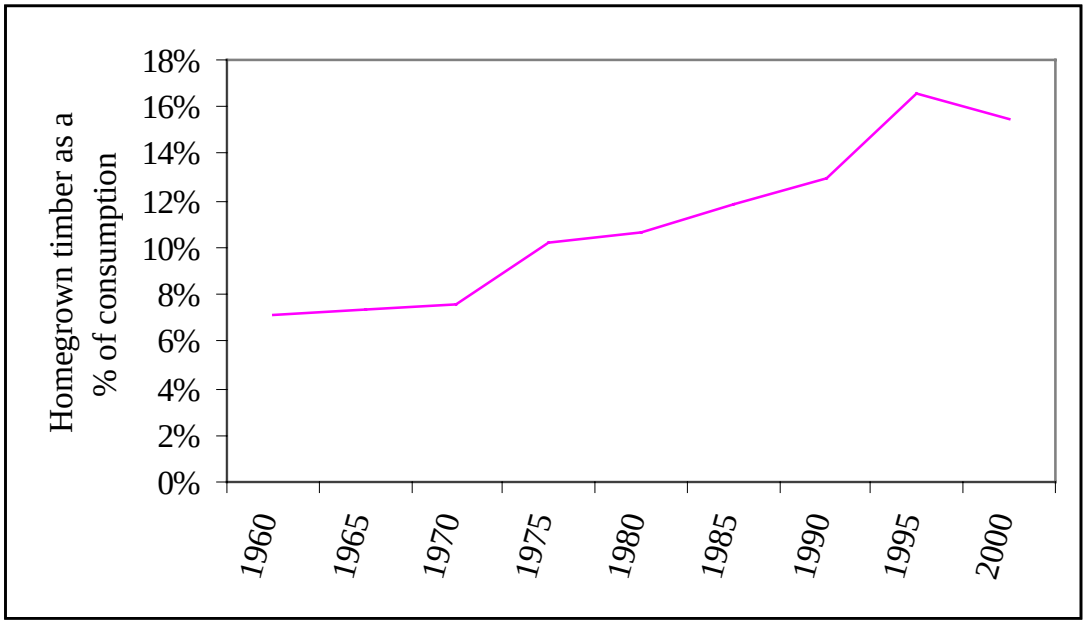
million m^3 WRME underbark

Year	Imports[1]	Exports[1]	Homegrown	Apparent Consumption	Homegrown %
1960	36.0	0.8	2.7	37.9	7.1%
1965	39.1	0.8	3.0	41.3	7.3%
1970	40.3	1.2	3.2	42.3	7.6%
1975	30.9	1.0	3.4	33.3	10.2%
1980	34.7	2.3	3.9	36.3	10.7%
1985	37.5	2.3	4.7	39.9	11.8%
1990	48.4	4.7	6.5	50.2	12.9%
1995	44.3	6.0	7.6	45.8	16.6%
2000	48.6	7.7	7.5	48.5	15.5%

[1]Source: UK Overseas trade statistics and conversion factors

Note : Apparent consumption = imports – exports + homegrown. It excludes recycled wood and waste paper of UK origin.

Proportion of wood and wood products consumed which is homegrown



D4. Home-grown as % of consumption *cont.*

Key Points Homegrown timber meets about 16% of UK consumption of wood products (excluding recycled material)

Relevance The resource costs of transporting timber for international trade and the impacts on forests in other countries are considerations for sustainable development.

Trend The percentage of homegrown timber has risen from around 7% in the 1960s to 10% in the mid-1970s and around 15% in the 1990s. It could rise to around 25% when UK timber production reaches a peak in the period 2015-2025.

Background Total consumption of wood products has tended to increase with economic growth. However it is driven more strongly by specific requirements for construction timber and by the product life cycles for particular products. The growth in apparent consumption is less rapid, because of the increased use of recycled wood and waste paper.

Notes An alternative approach would be to estimate the volume (wood raw material equivalent) and/or value of apparent consumption for each category of products, and estimate the proportion of each coming from UK timber. This would give a lower percentage share for UK timber, because the denominator would include products from recycled material (especially waste paper). An initial estimate (from work for SFS indicators) suggests 10-11% by quantity and 8-9% by value for 2000.

D5. Carbon storage

IN EUROPE;

Estimated amount of carbon which is sequestered to woodland in Europe each year, assuming 50 % carbon content of trees

	million tonnes C yr $^{-1}$
Amount of carbon sequestered in the actual growth of tree wood	279.0
Amount of carbon sequestered in the net growth of tree wood	115.0
Amount of carbon sequestered in long-term forest soil	9.3

Figures from estimation by De Vries *et al.* 2000

IN THE UK;

Biomass and carbon content of woodland in the UK in 1995, as presented in TBFRA 2000

	Conifer	Broadleaved	Total
Biomass: Million tonnes oven-dry			
Trees on forest	82	106	188
Trees outside forest			27
Other woody biomass (shrubs/ bushes)			5
Stumps & roots			44
Million tonnes carbon			
Trees on forest	41	53	94
Trees outside forest			13
Other woody biomass (shrubs/ bushes)			2
Stumps & roots			22

Notes:
1: Tree is total above stump, including branches, not just stem. Biomass is dry weight.
2: Biomass is calculated by multiplying the standing volume of timber by the following factors; conifer 0.43 and broadleaves 0.83
3: Standing volume used is from the 1980 census projected forward to 1995. This has not been updated to be consistent with the growing stock figures in D1, but the two should be revised to be consistent before final publication.

D5. Carbon storage *cont.*

Key Points Estimates compiled for TBFRA 2000 would imply that UK forests absorb about 5 million tonnes of carbon a year. These estimates were not able to make use of results from NIWT 1995-99, so they can now be revised.

Relevance The fact that plants absorb and store carbon dioxide (CO_2) means that they can help to reduce its concentration in the atmosphere. Processes like this that lock up carbon are known as "carbon sequestration". Although the main aim of the Kyoto Protocol is is to secure agreement on reducing *emissions* of greenhouse gases at source, it also recognises forestry as a way of helping to reduce *concentrations*. The value of offsetting emissions by sequestration is controversial but there is widespread international agreement that the store of carbon represented by forest ecosystems should be protected and enhanced.

Trend The amount of carbon sequestered in the growth of tree wood is proportional to the volume of growing stock, but varies with the mix of broadleaves and conifers. This has been increasing in recent years (See indicator D1).

Background The global atmospheric concentrations of carbon dioxide (CO_2) have increased since industrialisation and it is now widely accepted that human activity has been the principal reason. Although much of the increase has been due to emission of CO_2 from burning of fossil fuels, a significant proportion has come from the clearance of forests especially in the tropics. CO_2 is released not only from burning or rotting of felled trees but also from the disturbance and subsequent mineralisation of the forest soil. Protection of the carbon store in existing forests is an important principle of sustainable forest management. Increasing the terrestrial carbon store through planting new forests is also encouraged by international agreements such as the Kyoto Protocol. The amount of carbon stored in UK forests planted since 1920 is estimated by growth and yield models operated on behalf of the UK government by CEH. An annual report of total carbon stocks in UK forests is published. It is important to recognise that the amount of carbon sequestered by woodland (and other terrestrial ecosystems) does not increase continuously. At maturity, the carbon taken up by plant growth is balanced by losses from the decay of litter. Clearly harvesting will also reduce the carbon stock but only temporarily assuming replanting occurs. Because of the age structure of our forest estate, the total figure is close to a peak currently and is likely to decrease over the next decades.

D6. Economics of forestry

IPD Forestry Index 2001
Nominal three year annualised return for private sector Sitka spruce plantations

Year	Total return (% pa)
1992-1995	4.4%
1993-1996	9.9%
1994-1997	7.9%
1995-1998	4.5%
1996-1999	-3.0%
1997-2000	-5.2%

UK Gross value added (GVA) at basic prices for SIC 02 (forestry and logging)
Values are in current prices, not converted to constant prices.

Year	SIC 02 GVA £ million	% of UK total GVA
1992	289	0.05%
1999	276	0.03%

D6. Economics of forestry *cont.*

Key Points For forest owners, the nominal three-year annualised forestry return to end-2000 was –5% a year, driven down by falling timber prices in the late 1990s. The contribution to the national economy (gross value added at basic prices) in 1999 was £276 million, equivalent to 0.03% of the UK economy.

Relevance To attract long-term investment in forestry, it is necessary for forest owners to receive returns similar to other investments, or to receive non-financial returns (e.g. enjoyment from living or sporting in woodland). From the national viewpoint, an increasing value added from forestry contributes to economic growth (Gross Domestic Product or now Gross Value Added).

Trend The return to forestry (nominal three year annualised) has declined from almost +10% in 1993-1996 to –5% in 1997-2000, during a period when timber prices fell by more than 50%. Forestry's contribution to gross valued added at current prices fell between 1992 and 1999, as increases in wood harvesting were offset by falling timber prices and by varying expenditure not related to wood production; so forestry took a falling share of the UK economy.

Background The economics of forestry can be looked at from at least three viewpoints: the forest owner, the forestry sector, or the contribution to the national economy. Returns to the forest owner are made up of sales of timber (standing or felled), sales of other goods and services, increases in the value of the woodland (from annual increment or market factors), and the net income from subsidies (e.g. planting grants) less taxes. The owner's costs are made up of employment costs and other purchases. Official survey information is not yet available to monitor this for a representative sample of all woodlands, but estimates of the overall return from commercial Sitka spruce plantations are produced annually in the IPD Forestry Index. For the forestry sector as a whole (Standard Industrial Classification (SIC) 02 - 'forestry and logging' in the National Accounts), the earnings from employment should be viewed as part of the value added by forestry, rather than as a cost. In measuring the net economic contribution of forestry to the economy, it is desirable to subtract subsidies (grants) and add taxes, to get the value added at "basic prices". At present, National Accounts data for forestry are based on estimates, but better data will soon be available from the Annual Business Inquiry, which was extended to forestry in 2001.

Notes The pan-European indicators of SFM have not yet decided what economic indicators to include. The current proposals include a set of micro-economic indicators for woodland owners, but undecided whether they should be for income or net revenue, and a macro-economic indicator of contribution to GDP (gross value added).

D7. Value added in wood processing

UK Gross value added (GVA) at basic prices for primary wood processing
Values are in current prices (£ million), not converted to constant prices.

Year	**1992**	**1999**
Wood & wood products	1,686	2,109
Pulp paper & paperboard	905	1,261
Total	**2,591**	**3,370**
Total as % of UK total GVA	0.48%	0.43%

[In future could include Scottish figures for 1998, as compiled for SFS indicators]

D7. Value added in wood processing *cont.*

Key Points Primary wood processing contributed £3,370 million to the UK economy (gross value added) in 1999. This covers all primary wood processing in the UK, not just the processing of UK timber.

Relevance This measures the value added by wood processing in the UK, but is not directly related to the outputs of UK forests, because the processing includes use of imported and recycled material. Estimates of the value added through processing of UK timber should be available from the UK forestry multiplier study, to be published in early 2002, and these should be incorporated into the indicator.

Trend Gross value added in primary wood processing grew by 30% between 1992 and 1999, compared with a 45% increase in the total UK economy at current prices, so the sector continued to represent less than 0.5% of the total UK economy.

Background Statistics for gross value added are taken from the input-output tables that are the basis for UK national accounts. At present, these accounts are not broken down by country or region, although a separate set of input-output tables and accounts exists for Scotland. The figures presented in this indicator are for primary wood processing, which is made up of SIC 201 (sawmilling etc), 202 (veneers, panels and boards) and 211 (pulp, paper and paperboard). This includes processing of imported material; indeed the sample for SIC 211 actually omits all integrated pulp & paper mills that use UK wood.

Notes The pan-European indicators are likely to use a wider definition of the wood processing sector, to include products of paper and board and perhaps wooden furniture. These are not included in the UK indicator, because their link to UK forestry is even more tenuous.

UK Indicators of Sustainable Forestry

E. People and Forests

E1. Visits to woodland

E2. Extent of open public access

E3. Employment in forestry and related activities

E4. Accidents in forest workforce

E5. Value of social & environmental benefits

E6. Historic environment

E7. Public awareness and community involvement

E1. Visits to woodland

GB day visits to woodland

millions of day visits from home

	journey starting point			
	England	Scotland	Wales	**GB**
1994	273	18	12	**303**
1996	308	26	11	**346**
1998	321	22	11	**355**

Source: UK Day Visits Surveys

% of adults who had made a "day visit from home" in last year

	journey starting point			
	England	Scotland	Wales	**GB**
1994	37	32	32	**36**
1996	40	39	31	**37**
1998	39	34	31	**38**

Source: UK Day Visits Surveys

% of adults who had visited in last few years

	journey starting point			
	England	Scotland	Wales	**GB**
1995	73	59	61	**71**
1997	75	78	61	**75**
1999	68	60	63	**67**
2001	73	62	70	**72**

Source: Public Opinion of Forestry surveys

E1. Visits to woodland *cont.*

Key Points It is estimated that there are around 350 million leisure day trips from home to woodland in GB each year. 38% of adults had made a leisure day visit from home in the past year. The wider measure in the Public Opinion survey shows that 72% had visited in the last few years.

Relevance Recreation in woodland contributes to quality of life. This indicator shows the extent to which people are benefiting from the woodland recreation opportunities that are available.

Trend The reported number of day trips to woodlands increased from 300 million in 1994 to 350 million in 1998. There is no clear trend in the two alternative measures of participation

Background There have been four UK Day Visits Surveys (UKDVS) in 1993, 1994, 1996, 1998. The UKDVS estimates the total number of leisure day visits to woodlands from home, and the perceived woodland ownership. The next DVS will be carried out during 2002. The Public Opinion of Forestry survey is carried out every two years, and includes a set of questions about visits to woodland.

Notes There are no statistics at present on the number of non-leisure visits or trips made by holidaymakers. Trends Index data compiled by the Forestry Commission gives year on year changes of visitors to FC woodlands, but due to unreliability of the available data and lack of data for small sites, this is not recommended as an accurate source of data. A current project aims to develop an improved methodology for estimating the number of visitors to FC woodlands, by country and type of visitor.

E2. Extent of open public access

[This should have a map, showing the distribution of woodland compared with population distribution. This is not yet available, but should be compiled in spring 2002]

E2. Extent of open public access *cont.*

Key Points Open access beyond rights of way is estimated to exist for 281,000 hectares of woodland in England and 114,000 in Wales (of which 153,000 and 97,000 respectively is FC woodland).

Relevance Open public access provides opportunities for social enjoyment of the forest through walking. This does not imply that the area is available for other recreational activities. The aim is to increase the area with access, but the public benefit from access also depends on its location (proximity to communities) and provision of walking routes. It would be desirable to supplement this indicator with other measures, such as the population with adequate woodland access close to their homes (e.g. within 10 km), and/or the area for which recreation infrastructure exists.

Trend The area of private woodland with public access has been increasing, through the creation of community woodlands and through incentives to provide access (including management grants and the Walkers Welcome package introduced in 1994). The extent of access could be affected by "Right to Roam" legislation.

Background Some reasons why public access can be limited: Many woodlands are difficult to reach/ pass through; Woodland could be surrounded by land not belonging to the owners (e.g. arable land); Concerns about damage to property; Conflicts between user groups; Wildlife/ loss of privacy. There may also be temporary closure, for public health reasons (e.g. foot & mouth), forest operations or sporting activities. Woods with open public access may not be accessible by all (e.g. those with disabilities).

Notes Estimates for England & Wales quoted above are from the joint report "Improving access to woods, watersides and the coast", published by the Countryside Agency. Similar estimates have not been compiled for Scotland or Northern Ireland. Needs further work to estimate the extent of open public access to private woodland.

E3. Employment in forestry and related activities

Employment in forestry and primary wood processing in GB, by activity 1998/9

full-time equivalents

Activity	England	Scotland	Wales	Great Britain
Forest nurseries	421	201	2	624
Establishment	1,088	1,189	252	2,529
Maintenance	1,680	1,304	380	3,364
Harvesting	2,330	1,947	493	4,770
Road construction	181	179	47	407
Other forest	466	372	144	982
Total forest	6,166	5,192	1,318	12,676
Haulage	326	593	142	1,061
Processing	5,952	3,083	2,192	11,227
Other non-forest	2,295	1,826	447	4,568
Total non-forest	8,573	5,502	2,781	16,856
Total	14,739	10,694	4,099	29,532

E3. Employment in forestry and related activities *cont.*

Key Points Total employment in Forestry and the Wood Processing Industries in 1998/99 is estimated to be around 29,500 full-time equivalents (FTE's). England had around 14,700 FTE's, Scotland around 10,700 FTE's and Wales around 4,100 FTE's.

Relevance Employment provided by forestry contributes to sustaining rural economies. It would be desirable to identify how much of the forestry employment is in rural areas, but this breakdown is not currently available from the Forest Employment Survey.

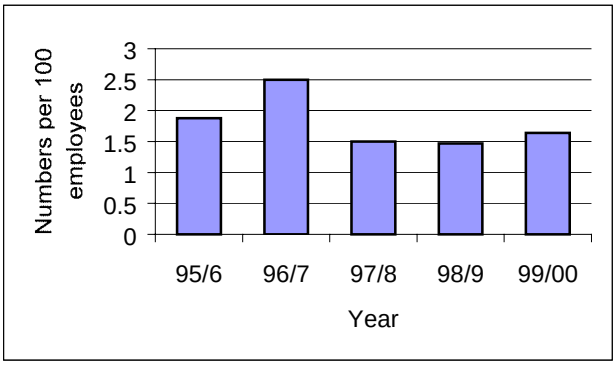
Trend Employment in forestry decreased during the 1990s.

Background The scope in the 1998/9 survey is wider than in previous years, to encompass Local Authorities, research organisations, woodland associations and other woodland initiatives, mostly shown in the other non-forest category.

Notes There have been 3 Forest Employment surveys that give the breakdown of employment by activity (1998/9, 1993/4 and 1988/9). Each survey used a different sampling frame and the results are not fully comparable.

E4. Accidents in forest workforce

Forestry Commission – reported accidents in GB



[In future add statistics based on HSE data for total reported accidents (and of which, fatal), expressed as rates per 100 employees, for SIC 02 (forestry and logging)].

E4. Accidents in forest workforce *cont.*

Key Points There is concern about the high rate of accidents among forestry workers, but at present there are no comprehensive statistics.

Relevance Safe working practices should be promoted as part of Sustainable Forestry. However the statistics given at present for this indicator only give a partial picture (FC only), and include office employees working in the government department of forestry (for whom accident rates are not a similar concern).

Trend In the Forestry Commission, the number of injuries per 100 employees has stayed about the same in the past 3 years.

Background These figures are the number of injuries within the Forestry Commission reported to HSE. A country breakdown is available for FE and industrial employees only. Accidents in the private sector (including contractors working in FC woodlands) are also reported to HSE - although it is believed that around 50% of accidents that should be reported to HSE are not reported, the trend over time may provide a useful indicator.

Notes Systems for recording FC accident statistics are likely to change so future figures are not likely to be compatible with those shown. It is difficult to obtain accident statistics that are a true measure of the whole industry, because of under-reporting and different classifications. FC also collects accident statistics for members of the public, but these will not cover all accidents, as they rely on members of the public reporting the accidents. A Safety Survey has been carried out for FASTCO, on two occasions during the 1990s; based on interviews with forestry workers, this survey reported on awareness of safety issues and implementation of safe working practices.

E5. Value of social and environmental benefits

[This will indicate what sorts of measures will be available from the current study of Social & Environmental Benefits of Forestry, but final data from this source will not be available until 2003.]

E5. Value of social and environmental benefits *cont.*

Key Points The social and environmental benefits (SEBs) of forestry include recreation, biodiversity, landscape, carbon sequestration, pollution absorption, archaeological and water quality due to forests and woodlands. The Forestry Commission has commissioned a study to estimate the public value of SEBs, which is due to be completed in 2002.

Relevance SEBs are important outputs from forestry activity, and this importance is recognised in the objectives of sustainable forest management. Their estimated values indicate people's preferences, which can be used to inform the policy for both public and private forests and woodlands. It would be desirable to extend this to include forestry's contribution to benefit people's physical and mental health.

Trend The values of SEBs are not collected on a regular basis and so there is no trend data available. Previous studies have estimated the values of various forest SEBs, but since methodologies are being constantly developed any comparisons have to be treated with caution. A recreation value of over £1 per visit has been accepted as a basis for supporting forestry by public expenditure.

Background SEBs can be categorised into direct use (e.g. recreation and landscape), indirect use (e.g. biodiversity and carbon sequestration) and non-use (e.g. existence and option). SEBs are mostly not captured in market processes, so their values have to be estimated using economic methods which usually require high levels of expertise and time.

Notes The current study to estimate the value of SEBs is being carried out by a team of economists and will estimate the total value of SEBs across Britain. The study is also investigating the value of marginal changes so as to provide a tool to assist in forest management. The FC has commissioned previous studies on the SEBs of recreation (Benson and Willis, 1990), biodiversity (ERM, 1996) and landscape (Entec, 1996).

E6. Historic environment

Number of Scheduled Ancient Monuments (SAMs) and ancient monuments in woodland

FC/FS Woodland	GB	Northern Ireland[1]	UK
Scheduled Ancient Monuments	980[3]	46	
Total Monuments		339	
Private Woodland	GB	Northern Ireland[2]	UK
Scheduled Ancient Monuments			
Total Monuments		385	

[1] figure from NI Forest Service; [2] figure from EHS; [3] Figure from FC

Other data:

- Number of monuments with management plans
- Of those SAMs with agreed management plans specifying action, proportion where that action has been undertaken. This will involve close cooperation with the relevant national heritage agencies.

E6. Historic environment *cont.*

Key Points There are many Scheduled Ancient Monuments (SAMs) in woodland, some of which have agreed management plans. There are a number of designations that aid the recognition of elements in the historic environment, but of these SAM is the only one with UK coverage.

Relevance Sustainable forestry must take account of the cultural heritage of woodlands. In part, this can be measured by monitoring of SAMs in woodland many of which relate to earlier land-uses. Conservation of other archaeological sites and features associated with the history of woodland management may be equally, or more important.

Trend The number of SAMs with agreed management plans is increasing through a number initiatives.

Background The landscape of the UK is a record of thousands of years of human activity. Insensitive woodland management or poorly located new planting can adversely affect the historic environment and associated features and the understanding and appreciation of future generations.

Notes Indicators initially proposed were; number of SAMs in woodland, the number of woodland SAMs with agreed management plans and the proportion of SAMs where action had been taken where agreed management plans had specified actions. The conservation of SAMs in woodland can be measured by noting agreements between individual owners and the relevant heritage agency. Some of the heritage agencies (e.g. Historic Scotland) are currently developing heritage indicators. In addition many SAMs lie in woodland covered by WGS agreements which will address issues where woodland management is an issue.

E7. Public awareness and community involvement

People who had heard or read about British forests, woods and trees in the media in the last 12 months

% respondents who had heard or read something

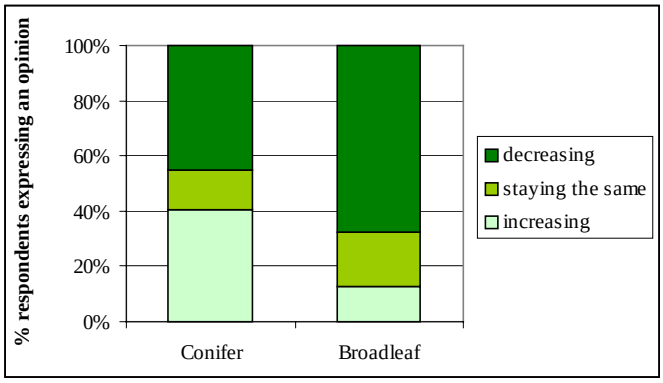
	1995	1997	1999	2001
Have you seen or read about British forests, woods or trees on the TV, radio or in the newspapers?	73	71	64	62

Public perception of the change in area of conifer and broadleaved woodland over the last 20 years

% respondents who gave an opinion

Conifer			Year	Broadleaf		
Increasing	Staying the same	decreasing		Increasing	Staying the same	Decreasing
48	8	44	**1995**	13	11	76
47	22	36	**1997**	14	26	60
41	16	39	**1999**	14	22	64
40	15	35	**2001**	13	20	67

2001 public perception of change in area of conifer and broadleaved woodland over the last 20 years



Public awareness of woodland organisations/ initiatives

% respondents who had heard of each organisation/initiative

	1995	1997	1999	2001
Forestry Commission	76	77	72	72
Woodland Trust	48	56	54	50
Community Forests	**	**	**	11
Forest Enterprise	10	8	9	9
Forest Stewardship Council	**	**	2	4
Trees of Time and Place	**	**	1	2
Wood For Good	**	**	**	2
None / Don't know	2	3	4	6

** These organisations/ initiatives were not asked about in these years

Source : Public Opinion of Forestry surveys

E7. Public awareness and community involvement *cont.*

Key Points About two-thirds of the public are aware of forestry issues in the media. There is still a widespread public perception that the area of woodland is decreasing. Almost three-quarters of the public have heard of the Forestry Commission, and half have heard of the Woodland Trust, but few have heard of other initiatives set up more recently.

Relevance Sustainable forestry requires that woodland creation and management take accounts of the needs of local communities, and involve the communities in decision making. This can include improving public awareness and access to information, as well as increasing active participation in decision making.

Trend Although 73 % of the public had heard about woodland and trees in the media in 1995, fewer have done so in recent years. Despite the fact that the area of conifer and broadleaved trees has continued to increase in the last two decades, a large proportion of the public still perceive that the area of woodland in GB is decreasing.

Background Public awareness of forestry has been assessed since 1995, through the biennial 'Public Opinion of Forestry' of 2000 households in GB.

Notes Other measures could be the number of community groups that are involved in managing woodland, and the area of woodland that they manage; estimated figures for Scotland (SFS indicators from Reforesting Scotland) are 100 groups and 20,000 hectares. Other qualitative measures could include the existence of consultation processes and guidelines, demonstrating that those who want to be involved have appropriate opportunities, but not requiring all to participate.

Glossary

ASNW	Ancient Semi-Natural Woodland
BAP	Biodiversity Action Plan (see also HAP and SAP)
BTO	British Trust for Ornithology
CADW	Cadw: Welsh Historic Monuments Executive Agency
CEH	Centre for Ecology and Hydrology *(formerly the Institute of Terrestrial Ecology)*
CS2000	Countryside Survey 2000
C&I	Criteria and Indicators
DETR	Department of the Environment, Transport and the Regions
EA	Environment Agency
ECN	Environmental Change Network
FASTCO	Forestry and Arboriculture Safety and Training Council
FC	Forestry Commission
FCS	Forest Condition Survey
FE	Forest Enterprise
FMU	Forest Management Unit
FR	Forest Research
FRA	Forest Resources Assessment
FS	Northern Ireland Forest Service
FTE	Full-Time Equivalent
FSC	Forest Stewardship Council
GIS	Geographic Information System
GNP	Gross National Product
HAP	Habitat Action Plan (part of the BAP process)
HSE	Health and Safety Executive
IO	Input-Output
IPCC	International Panel on Climate Change
IUCN	The World Conservation Union
MAFF	Ministry of Agriculture, Fisheries and Food
MCPFE	Ministerial Conference on the Protection of Forests in Europe
MDF	Medium Density Fibreboard
MoD	Ministry of Defence
NCB	National Coal Board
NIWT	National Inventory of Woodland and Trees
NRS	Northern Research Station – Forest Research, Scotland
ONS	Office for National Statistics
OSB	Oriented Strand Board
OSNW	Other (not ancient) Semi-Natural Woodland
QOLC	Quality of Life Counts, UK sustainable indicators
RSPB	Royal Society for the Protection of Birds
SAM	Scheduled Ancient Monument
SAP	Species Action Plan (part of the BAP process)
SEPA	Scottish Environmental Protection Agency
SFM	Sustainable Forest Management
SoCC	Species of Conservation Concern
TBFRA	Temperate and Boreal Forest Resources Assessment
TGA	Timber Growers' Association
UKAWMN	UK Acid Waters Monitoring Network

UKDVS	UK Day Visits Survey
UKFS	UK Forestry Standard
UKWAS	UK Woodland Assurance Standard
WGS	Woodland Grant Scheme
WRME	Wood Raw Material Equivalent
WWF	World Wide Fund for nature

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Countryside Survey	http://www.cs2000.org.uk
DEFRA	http://www.defra.gov.uk
Environment Agency	http://www.environment-agency.gov.uk
Forestry Commission	http://www.forestry.gov.uk
Forest Stewardship Council	http://www.fscoax.org
SEPA	http://www.sepa.org.uk
Temperate and Boreal Forest Resource Assessment	http://www.unece.org/trade/timber/fra/